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ELECTRICAL WORLD

JANUARY 31, 1931

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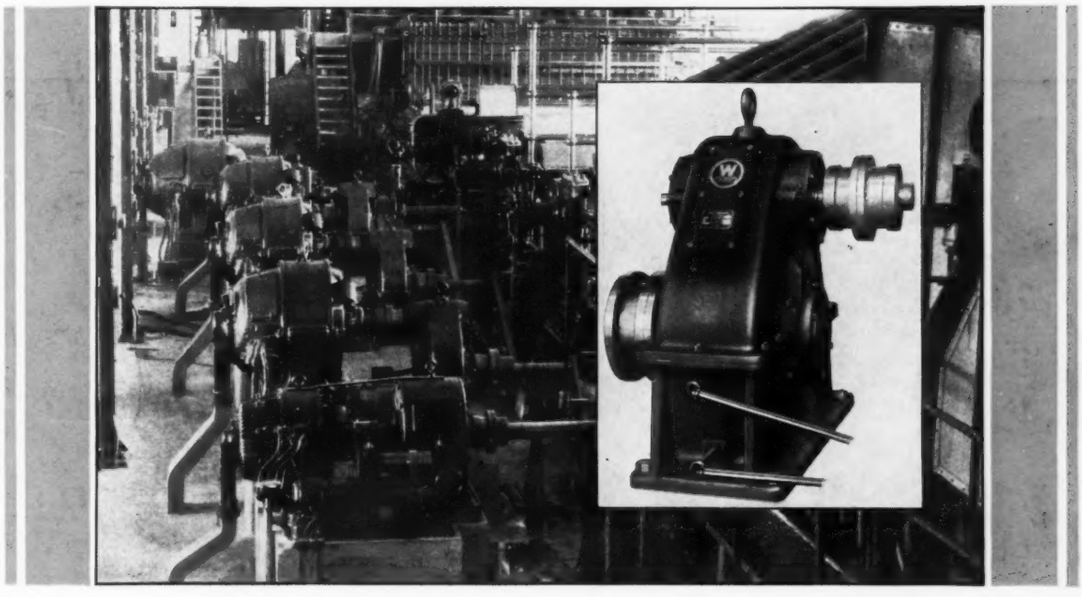

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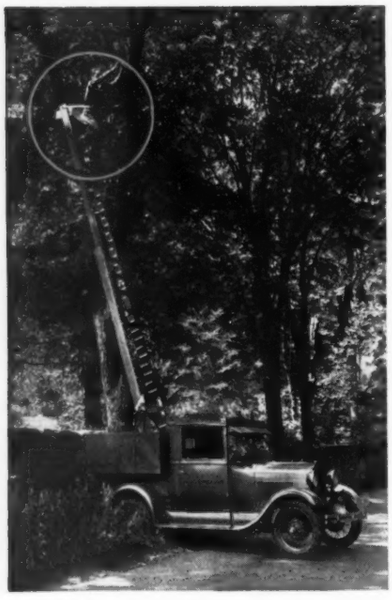

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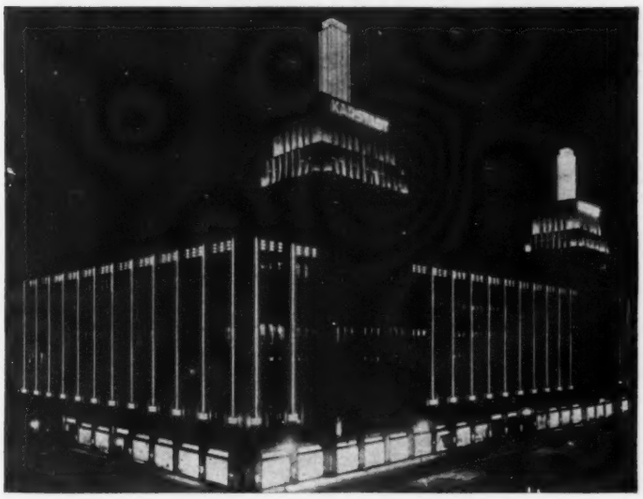

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JANUARY 31, 1931

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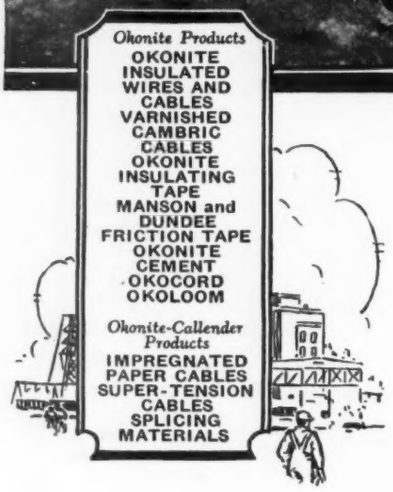

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ELECTRICAL WORLD

for the Week Ending

January 31, 1931

Fight uneconomic political projects, Lee warns A. I. E. E.

Senators now call for court action to oust commissioners

Muscle Shoals was a colossal political and governmental error, but I fear that the next decade will see even greater ones if some of the projects under way now, or projected, are constructed. It looks as if the public were being ballyhooed for another Muscle Shoals, only on a more gigantic scale.

W. S. LEE,
President American Institute of Electrical Engineers.

—**Power Board fight continues** with senators firm in their demand for ousting of three commissioners. Judiciary committee votes for court action—*p. 215.*

—**Off-peak heating of offices** has been tried before, but here is a utility company which builds a new home with sole dependency on electricity to meet New England winters and expects to show economies—*p. 243.*

—**A.I.E.E. meets in New York** for its annual convention. Better service remains engineer's main concern. Lightning, circuit breakers and inductive co-ordination dominate—*p. 214.*

—**Oil fields poorly electrified** is conviction of utility men serving the territory. Not 10 per cent of power is electric. Conference discusses problems of this alluring load—*p. 216.*

—**New ideas in circuit breakers** keep this branch of the electrical art in turmoil. Perfection remains far afield, but improvement evolves from research. Commercial situation a growing problem—*p. 230.*

—**Washington's power districts** do not mean so much right now. More of a threat than a promise, is interpretation of voters' action in authorizing utility competition in that state—*p. 240.*

—**Power-telephone co-operation** on basis of a ten-year program, for technical and industry unity of efforts, brought order out of chaos and improved service to the public—*p. 233.*

—**Railroad power and its cost** discussed by electrical engineers. What is a fair price? What bases shall be established? Another step to speed the electrification of America—*p. 224.*

Winter Convention of Institute Full of Interest and Profit

WITH the usual excellent attendance, registration reaching 1,500, and with trips of inspection that enabled the visiting engineers to supplement knowledge acquired by ear with that gained through visual demonstration, the winter convention of the American Institute of Electrical Engineers, held at New York headquarters, again scored its customary success this week. President Lee's address was a clarion call to engineers to protest against government ownership as a waste of the nation's resources and a subversion of American individual initiative. The smoker and the dinner-dance added the note of social intercourse and promotion of acquaintanceship, and the presentation of the Edison medal to Dr. Frank Conrad drew the attention of press and public.

On Tuesday morning technical sessions opened with four papers on inductive co-ordination, the program then and throughout the convention following closely the outline printed in the ELECTRICAL WORLD for January 10 (page 86). The discussions on co-ordination indicated clearly the great progress made since the quick agreement of nine years ago between the major groups in each of the industries to abandon ineffective litigation and resort to methodical analysis along technical and economic lines, thus benefiting the public, which supports the two services, both through improvement of operation and through the rate reductions made possible and effected.

Protective devices were the theme of seven papers in the afternoon. Insulation against lightning proved, as always, a provocative topic, and comment by Dr. J. Slepian and J. B. MacNeill upon circuit-breaker preformance theories as expressed by D. C. Prince and W. F. Skeats led to a lively discussion terminating in a general recognition of the excellences of field service of such apparatus.

The cognate topic of power transmission was treated in Wednesday morning's session, the five papers including one concerning lightning experience on the American Gas & Electric Company's 132-kv. lines. Favorable comment was presented by several speakers upon the analytical methods now in vogue in studying interruptions due to lightning. Low tower resistance to ground (5 ohms or less) appears essential in localizing the onslaught of direct strokes.

In the evening came the open meeting, with the presentation of the Edison medal. In bestowing it Past-President Charles F. Scott alluded to the initiative and creative achievements of the recipient in many branches of electrical engineering and paid high tribute to his pioneering contributions to the art. Dr. Conrad responded briefly, pointing out the value of the scientific method of approach to engineering problems.

The presentation was followed by an address by President Karl T. Compton of the Massachusetts Institute of Technology in which he illustrated a closely reasoned talk on the electron by many fascinating experiments.

Industrial power applications, transportation, including papers on the Lackawanna Railroad electrification and the catenary system of the new Cleveland terminal; electrical welding, research in cable laying, traffic control and other fields, and developments in electrical machinery provided subjects for five sessions on Thursday and Friday.

All the sessions of the convention will be covered in the ELECTRICAL WORLD's report next week.

▼

SPRAGUE PONDERS

—*Underwood & Underwood*

Frank J. Sprague, pioneer engineer and inventor in the electrical field, is here depicted at work on the original models of the dual elevator system which is now in service at the main office of the Westinghouse company in East Pittsburgh, operating under Sprague patents. (ELECTRICAL WORLD, *January 17, page 129.*)

Luminous-Tube Lighting at Low Voltages Announced

A STRIKING ADVANCE in lighting developments was announced this week by Leroy P. Sawyer, vice-president of Claude Neon Lights, Inc., New York, in connection with the production of rare gas tubes to operate on standard 110/220-volt circuits. By suitable mixtures of gases and improvements in electrode design a wide range of color effects is produced, with uniform flux distribution, full daylight effects, increased efficiency of operation and added life of units. The cathode is initially heated by a 6-volt coil which is cut out of circuit automatically after the luminous discharge starts. The new low-voltage tubes have attained a luminosity as high as 2,000 lumens per foot compared with 60 to 132 lumens per foot for high-voltage luminous tubes. They are adapted to commercial, industrial and special residential applications, notably in panel and recessed units.

▼

President Jones Says Service Must Be Sold

COMPARING UNFAVORABLY the progress of the electrical industry commercially with its great engineering achievements, President W. A. Jones of the National Electric Light Association told the Electrical Association of New York on Wednesday of this week that there has been no adequate plan for expending money and effort to get business and that there has been a lack of co-operation between the branches. Market possibilities are almost limitless, he said; talk of saturation is absurd.

Among opportunities for enterprise he enumerated air conditioning in homes, offices and factories, ventilation and cooling, health appliances in home and office, better home lighting, correction of existing insurance violations, rural electrification, highway lighting for safety, complete industrial motorization and industrial electric heating. Rational rate structures and complete co-operation between light and power companies, contractors and dealers would get the business.

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Utility Problems Draw Statisticians' Attention

PUBLIC UTILITY PROBLEMS were discussed from several points of view before the American Statistical Association on Wednesday evening when the members held a dinner meeting in

New York. Martin J. Insull, president Middle West Utilities Company, described the benefits from consolidation and told how great power systems have been built up. Dr. John Bauer, utility expert, gave his reasons for thinking that the domestic customer had been discriminated against in the matter of rates in order to favor industrial consumers and appealed for a standardized rate base. Thomas F. Woodlock, ex-member of the Interstate Commerce Commission, opposed public ownership and pointed to the low rates attained in Washington, D. C., through contract between the political regulating body and the utility company. In conclusion Mr. Woodlock stated, "I wonder if the irritation against the electric rates is really felt by the customers or is stimulated by politicians." Jacob H. Goetz, a lawyer, argued for cost of reproduction new as the proper valuation system.

▼

Senate Still Fighting Power Board Members

STILL DISSATISFIED with the action of the Federal Power Commission on the reappointment of C. A. Russell, solicitor, and W. V. King, chief accountant, the Senate on January 23 adopted, by a vote of 45 to 32, a motion by Senator Walsh of Montana to recommit the names of Chairman George Otis Smith, Marcel Garsaud and Claude L. Draper to the interstate commerce committee of the Upper House, which approved their nominations before the Senate confirmed them in office.

Following the vote, Senator Walsh pressed for action in court against the commissioners, notice of whose confirmation President Hoover has declined to return. Upon Senator Walsh's motion, the Senate unanimously referred to its judiciary committee a resolution directing the District Attorney of the District of Columbia to institute *quo warranto* proceedings to ascertain if the three commissioners are lawfully in office. The judiciary committee voted by eight to three to do so, and the audit and control committee approved an appropriation, but Senator Shortridge blocked immediate consideration by the Upper House. In the meantime a motion made in the House of Representatives by Mr. La Guardia of New York to strike the salaries of the commissioners from the independent offices supply bill was defeated by 102 to 37.

Soon after the Senate had recommitted the names President Hoover gave out the text of an opinion by Attorney-General Mitchell, taking a position contrary to that assumed by the Senate.

FIRST UNIT AT CHUTE-A-CARON IS STARTED

This first plant of the Alcoa Power Company's hydro-electric project at Chute-à-Caron, on the Saguenay River, Quebec, will have a rating of 260,000 hp. in four units, of which the first has just started up. Ultimate development by the building of the Shipshaw plant will add nearly 800,000 hp., operating under a head of 205 ft.

▼ ▼ ▼

Maltbie to Stay as Head of New York Commission

GOVERNOR ROOSEVELT reappointed Milo R. Maltbie this week as chairman of the Public Service Commission for ten years at an annual salary of $15,000. The nomination was submitted to the Senate and confirmed at once.

▼

Muscle Shoals Motions Again Fail to Advance

IN THE SENATE on Wednesday motions by Senator Black, Alabama, to suspend the Senate rules in order that Muscle Shoals legislation might be considered as "rider" amendments to the War Department appropriation bill were twice defeated, receiving a majority but not the two-thirds vote required in procedure of this kind.

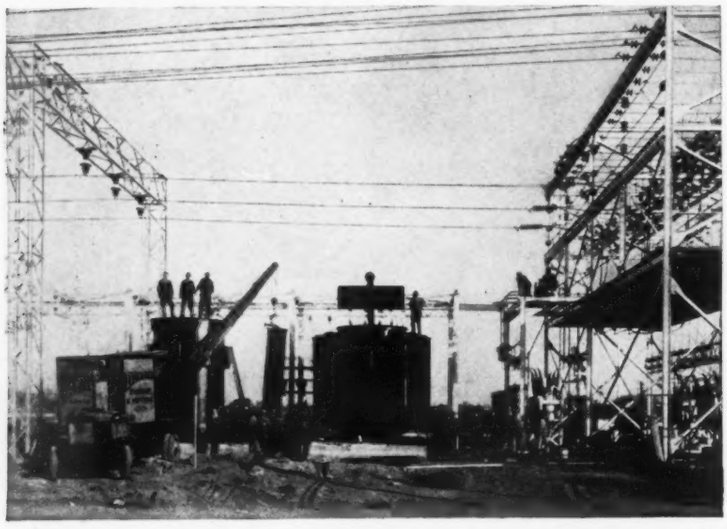
The amendments proposed by Senator Black would provide for the leasing of the nitrate plants at Muscle Shoals for fertilizer production and would direct the Secretary of War to give preference to municipalities in the sale of Muscle Shoals power. A motion by Senator Howell, Nebraska, directing the sale of Muscle Shoals power to municipalities for 4 mills a kilowatt-hour also failed.

Trade Investigators Reach Alabama Power Company

PURCHASE OF ELECTRIC POWER by the Alabama Power Company from the government plant at Muscle Shoals is an "advantage" to the company rather than a "necessity," according to testimony before the Federal Trade Commission on Monday of this week by Judson C. Dickerman, engineer examiner for the commission. Mr. Dickerman testified also on the company's rate schedules and its "real progress" in rural electrification and gave the company a high rating on the operating side.

Reviewing the corporate history of the company and its predecessors, testimony offered by Robert J. Rider, commission accountant, disclosed an appreciation of approximately $9,900,000. It was set forth that stocks valued at $9,975,000 were issued by the newly consolidated power company in 1913 in return for stocks of the constituent companies the par value of which was $99,500. It was also disclosed that the Electric Bond & Share Company marketed 49,329 shares of preferred stock for the company at a charge of $2 a share. Loans of approximately $51,000,000 were advanced by the Southeastern Power & Light Company at rates varying from 4½ to 6 per cent. Foreign investment was superseded in wartime as an influential factor.

LARGE TRANSFORMERS FOR MOUNTAIN STATE



A bank of three load-ratio-control transformers, rated in all at 37,500 kva., has recently been erected at the North Denver substation of the Public Service Company of Colorado. The picture shows two of them in process of installation.

▼ ▼ ▼

Tulsa Conference Seeks to Build Petroleum Load

UNIFORMITY OF CONTRACT FORMS and rate schedules and a closer approach to standardization of service conditions loom up as the first concerns of electric utilities in their efforts to acquire the loads represented in the production, transportation and refining of petroleum. This industry is not yet even 10 per cent electrified, and it constitutes probably the largest single field for the expansion of industrial electric service. These are the two outstanding points brought out by the "electric utilities power conference as applied to the petroleum industry," which was held at Tulsa, Okla., January 19 and 20, under the chairmanship of O. A. Jennings of the Oklahoma Gas & Electric Company.

Although the concern of the conference was with electricity supply to all branches of the petroleum industry, including production and refining, the feeling prevailed that it is with the third branch, transportation, that most immediate action must be taken by the utilities if they are to secure any appreciable share of the load represented by the present rapid extension of pipe lines for oil, gas and gasoline virtually all over the country. It is in this branch that the two most vexing problems of the situation occur.

The first of these, uniformity of contracts and rate schedules of utilities that might serve a pipe line throughout its length, was the subject of a paper by R. E. Keller of the Electric Bond & Share Company. The paper was based on an analysis of about 50 representative schedules from interested utilities. The diversities of these schedules, apparent in most striking manner when brought together for analysis, made it easily understood why the pipe-line operator would be inclined to use oil engines for pumping rather than to buy electricity under a multiplicity of different conditions and agreements. The matter of standardization, particularly in reference to voltages as affecting the costs of spare equipment—as, for instance, transformers that the pipe-line operator might want to use in various locations—received its share of discussion after a paper on "Engineering Problems," by E. T. Keck (read by G. E. Hengy) of the Texas Power & Light Company, had been presented.

The disposition of the oil industry to use its own products (largely on the basis of zero cost) for energy production rather than to purchase power was held to be a considerable obstacle in the way of expansion of central-station service in this field; but that this obstacle is not now so formidable as in years past was shown in three papers on production of petroleum, refineries and equipment manufacturing, by R. E. Hendricks, Texas Electric Service Company; W. S. Baugh, Kansas Gas & Electric Company, and Ralph Kelley, Westinghouse Electric & Manufacturing Company. These papers indicated perhaps a larger use of electricity in the fields of oil production and refining than is commonly known, but the use was shown to be still really small.

F. A. Graham, Kansas City Power & Light Company, and W. H. Stueve, Oklahoma Gas & Electric Company, were elected as chairman and vice-chairman, respectively, of the conference.

▼

Kansas Commission Will Watch Stock-Sale Time

INFORMATION OBTAINED by the Kansas Public Service Commission is said to indicate that 100 men and women attached to various gas and electric companies operating in Kansas under the Cities Service Company devote their time exclusively to "pushing" the company's stocks and making collections from installment buyers. Their compensation, it is understood, is paid by the companies from the revenues derived from sales of gas and electricity and is charged as operating expense.

Because of this stock-selling system the commission has issued an order to the Western Distributing Company, seeking increased domestic gas rates in 22 towns in the state, to segregate in time and dollars the service rendered by employees in attending to duties connected with the distribution of gas and their occupation as stock salesmen for the Cities Service Company. When this information shall have been received the commission will determine what proportion of the salaries should be charged to operating expense and what should be borne by the company as a financing charge.

▼

Ford Company Expands Its River Rouge Plant

RECENT DETAILS of the expansion now being carried on in the River Rouge (Mich.) plant of the Ford Motor Company say that the 110,000-kw. steeple-compound turbo-generator under installation by the General Electric Company (described in the ELECTRICAL WORLD for October 19, 1929, page 801) will be driven by steam from two new high-pressure boilers, each to generate 700,000 lb. an hour, said to be the greatest steaming capacity yet reached by a high-pressure boiler. New turbo-blowers, increasing the air output by 30,000 cu.ft. a minute to each of the plant's two blast furnaces, will constitute a third major addition to the River Rouge plant.

Another striking feature of the installation is the 2-mile water tunnel, 15 ft. in diameter, which will be capable of delivering 1,000,000,000 gal. of water a day.

Power and Regulation in State Legislatures

COLORADO.—The Public Utilities Commission is asking for an appropriation to enable it to initiate rate proceedings, from which, it thinks, "a substantial reduction in rates" may spring.

IDAHO.—The authority of the Public Service Commission of Idaho to issue certificates of convenience and necessity and to approve municipal franchises would be abolished by a bill introduced in the Senate.

INDIANA.—House bill 112 re-enacts the Public Service Commission law with amendments to provide that valuations for rate-making purposes shall be on the basis of cost less depreciation, instead of on reproduction value; that no utility shall manufacture or sell apparatus designed to consume its product if the property for such manufacture or the overhead for selling is included in the valuation of the utility, and that appeals from decisions of the Indiana commission cannot be taken to the lower federal courts, but must be taken to the Indiana Supreme Court and then to the United States Supreme Court. Another bill, introduced by Representative Reisinger of Evansville, would abolish the Public Service Commission entirely.

KANSAS.—A House bill prohibiting public utilities from selling merchandise has been introduced. If it becomes law, it will terminate a long-standing practice of electric and gas companies in Kansas.

MINNESOTA.—Provision for the submission of a constitutional amendment which would allow the state to acquire hydro sites, develop water power and distribute electricity is proposed in a Senate bill. Bills specifically carrying out Governor Olson's legislative program are also in process.

MISSOURI.—Under terms of a House bill the Public Service Commission would be required to make a rate-base valuation of each public utility in the state at least once every seven years. Another bill empowers the commission to examine into any charge made against a public utility by a holding company for supervision, services or managerial or financial assistance and also requires the commission to determine the reasonableness of any contract between a public utility and any company having an interest in or control over such utility. The bill further provides that in valuing a utility the commission shall be controlled chiefly by the original cost of the property and the cost of reproduction new less depreciation, but does not prescribe the exact formulas to be used to determine the relative weight of such costs.

NEBRASKA.—Three radical members of the House have introduced a bill prohibiting any person or corporation selling and distributing electrical energy from making a lower rate or price in any one section or community than is charged by it in other cities it serves within the state, after making due allowance for the difference, if any, in the actual cost of supplying such service. Permission is given to meet the rates of a bona-fide competitor. The same members sign another bill which fixes the kilowatt-hour as the standard unit for all charges made to consumers and specifically rules out under a penalty of $25 to $100 for each offense any readiness-to-serve, meter or delinquent charge. Senator Wherry has introduced a bill authorizing cities of the second class and villages to fix maximum inclusive rates for gas and electric companies operating under franchise.

OKLAHOMA.—A number of bills affecting public utility companies have been introduced. The most important is one for creating a tax commission composed of three members to be appointed by the Governor and who can be removed by him at will. The tax commission is required to render findings as to the assessment of all railroad and public service corporation property to the State Board of Equalization for its final action. This bill has already been passed and approved by Governor Murray and is now a law.

OREGON.—In his report State Engineer Stricklin recommends that all future contracts for the construction of water-power plants be subject to approval by the state and awarded to the lowest qualified bidder. He also recommends legislation giving the state authority to regulate and control the diversion of water from reservoirs constructed by individuals and corporations, except those of municipalities where constructed for other purposes than power development, and says further that the Governor should be authorized to appoint a committee to enter into compacts with other states for the construction, operation and maintenance of power dams and their appurtenances.

PENNSYLVANIA.—Senator S. W. Salus of Philadelphia has introduced a resolution asking that a committee of six Republican and three Democratic Senators investigate charges made by Governor Pinchot in his inaugural address that the government of the commonwealth is dominated by the public utilities. Senator W. H. Earnest of Dauphin, declaring that there is widespread belief that the charges of incompetence, neglect and failure to function properly are true, asks that the Public Service Commission be investigated by the joint judiciary committees of the Senate and House and that the report of its finding be submitted to the Legislature not later than March 3. Both of the Senators named are classed

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FURMAN SHOALS PLANT ADVANCING SURELY

Although not regarded as a rush job, satisfactory progress was made during the past year on the Georgia Power Company's 60,000-hp. development at Furman Shoals on the Oconee River, and a mass of concrete masonry has already been poured for the superstructure of the power house. The photograph shows the site as it appeared on December 1 last.

as anti-Pinchot men. Committee action was deferred to next week. A bill limiting the functions of the present Public vice Commission to those of a court and creating a new Department of Public Utilities was introduced in the House last week.

WEST VIRGINIA.—Senator Henshaw of Berkeley County has introduced a measure to increase the royalty charge to be collected by the state on generated water power from $10 per 100 hp. to $100 per 100 hp., or ten times the rate fixed by the Legislature of 1929. Another provision in the Henshaw bill makes it mandatory for the licensee to develop all parts of a group of projects for which a license has been granted within a period of one year, if any citizen elect to petition the Public Service Commission for a cancellation of the franchise. A third provision of the bill would require the commission to determine rates for power in accordance with the proximity of the consumer to the developing plant. Increased tax rates for utilities, together with a privilege tax on licensees under water-power grants, are among things proposed by other West Virginia legislators. A tax of 6 per cent on the value of power shown by the gross proceeds as produced in West Virginia is provided and the rate on electric light and power companies is to be increased from three-fifths of 1 per cent to 2 per cent under the terms of bills introduced.

WISCONSIN.—Two joint resolutions providing for constitutional amendments and two bills for public ownership and operation of utilities have been introduced in the Legislature by Senator O. S. Loomis of Mauston. The first constitutional amendment would allow the state to recapture water developments and to engage in the electrical business. The second constitutional amendment is identical with one passed in 1929 and exempts generating and distributing systems from the debt limitations of municipalities which want to go into the electrical business. One of the two bills offered by Senator Loomis provides for the creation of power districts, comprising cities and villages and intervening territory. The second bill gives to cities and villages the right to compete with privately owned utilities now serving those communities.

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Valuation Theories Split New York Commission

TWO CONFLICTING OPINIONS regarding an increase in rates which was granted to the Black River Telephone Company recently by a three-to-two vote of the New York Public Service Commission are attracting attention in utility circles in that state. The order was adopted through the votes of Commissioners Van Namee, Lunn and Brewster. Chairman Maltbie and Commissioner Burritt opposed it. The opinion on which the increase in rates was granted gives controlling weight to reproduction cost in determining the value of the property. The majority decision fixes the value at $900,000, or $250,000 more than book value.

The dissenting opinion holds that in the case at issue, with figures as of 1929, this method is "most unfair." "In the first place," the dissenting members say, "the book cost of the property ($950,000 in round figures) represents the estimated cost of the property as determined by an engineer some seven years ago employed by the company. . . . Over 70 per cent of the property actually in existence upon July 1, 1929, was acquired or constructed after 1916. This fact has a significant bearing upon the weight to be given to the figures from the books and records of the company; for if three-quarters of the property has been added since prices began to rise, due to the war, and if prices in 1929 were generally below the average for the thirteen years immediately prior thereto, it is obvious that the book figures already reflect to a very great degree the high level of prices, and it is not necessary, therefore, to give such weight to reproduction cost as would be necessary if the larger part of the property had been installed or acquired on a pre-war price level basis. . . . Even the small increase approved by the majority of the commission should not have been granted," the minority report concludes.

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Georgia Rate Hearings—Uniformity, Not Reduction

A HEARING BY THE Georgia Public Service Commission requiring the Georgia Power Company to show cause why its wholesale industrial and municipal power rates should not be revised to bring about greater uniformity was held recently at Atlanta. W. M. Lester of Augusta, president of the Municipal Utilities Rate Association of Georgia, and Dr. John Bauer of New York, a rate expert employed by the organization, contended that the hearing should be held on the whole rate structure of the company. They urged that a rate "at least as low as the lowest now in effect" be uniformly applied throughout the state and that the base rate for power sold communities for resale through their own distributing plants should be the same as that for industrial consumers.

Preston S. Arkwright, president of the Georgia Power Company, declared that the utility did not object to uniform rates but that conditions were such that it could not stand a reduction.

OLYMPIA'S FLOODLIGHTING STRICTLY MODERN

—Keystone View Company

Ancient Olympians might rub their eyes if they could view the exterior lighting of the new Washington State Capitol in the modern namesake of their sacred vale. This installation, a Crouse-Hinds undertaking, employs several hundred floodlighting units to illuminate the dome and hundreds of smaller units in the corridors back of the columns.

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Scattered Happenings in the Electrical Sphere

United States

BOTH SIDES SUMMED UP in this week's hearing of the long-drawn-out New York Edison rate case, the companies insisting that their offer was the best possible and antagonists threatening municipal competition if still lower rates were not established. Only one more hearing is to be held, if any.

HEARINGS ON THE APPLICATION of the city of St. Louis for a reduction in the rates of the Union Electric Light & Power Company to domestic consumers were resumed by the Missouri Public Service Commission at Jefferson City last week. R. N. Boyle, consulting engineer for the city, and Chief Accountant H. W. Ross of the commission testified, the latter saying that an audit of June 30, 1929, indicated that the cost of the company's fixed physical property was $54,969,411, the portion allocated to St. Louis being valued at just under $40,000,000.

BECAUSE OF THE BAD CONDITION of the municipal steam turbine at Little Rock, Ark., the city has closed down its plant for the time being and is buying all its energy from the Arkansas Power & Light Company.

AT A SPECIAL ELECTION the voters of Altamont, Ill., rejected by 434 to 258 a proposal that the municipal light and power plant and waterworks be sold to the Central Illinois Light & Power Company.

WITH FOUR SUPERIOR COURT judges on the bench to take the place of Supreme Court judges disqualified by stock ownership, presided over by Judge Marcus W. Beck, the only member of the Supreme Court free to hear the case, the arguments in the Crisp County power case were made on January 23. (ELECTRICAL WORLD, October 4, 1930, page 627.) Chairman James A. Perry of the Georgia Public Service Commission presented the commission's case. Attorneys for the power company claimed that the language of the commission's order to show cause was in reality a prejudgment and did not give the power company an opportunity to be heard. The court deferred decision.

CONSOLIDATION OF THE Conowingo Electric Light & Power Company and the Northern Maryland Power Company has been effected, the united company to be known as the Conowingo Power Company.

A PROPOSAL THAT THE Los Angeles City Council submit a municipal power bond issue for $19,000,000 to the voters at the general city election of June 2 next is under consideration by city authorities. A power bond issue of $13,300,000, submitted at the election last fall, failed to receive the necessary two-thirds vote.

THE DELAWARE POWER & LIGHT COMPANY of Wilmington, Del., announces a reduction in rate schedules for residential and commercial electric lighting, which will effect an annual saving to consumers of $135,000. The new rates become effective February 1. This is the fifth reduction within two and a half years. The previous reductions have effected a saving to the consumers of $330,000 annually.

THE INTERNATIONAL PAPER COMPANY won a victory in the Supreme Court last week when the court reversed a judgment of the Court of Claims and decided that the government must pay the company $304,685 for water rights it held in the Niagara River during the World War.

AN ORDER ISSUED by the Missouri Public Service Commission recently authorized the Empire District Electric Company to proceed with the construction and operation of its dam and power house at Table Rock, on the White River, in Taney County—a long-contemplated project that has encountered much enforced delay. The development, which awaits a federal license, is to be designed for an ultimate capacity of 250,000 hp.

BY A VOTE OF THREE TO TWO the City Council of Portland, Ore., has placed itself on record as being "in favor of a municipally owned and operated power and light system in the city" and taken the first step toward authorizing its Commissioner of Public Utilities to spend any or all of $25,000 budgeted by the city for investigation of the feasibility of such a system. The Mayor opposed the motion.

RESOLUTIONS CALLING FOR more expeditious handling of business coming before it have been adopted by the California Railroad Commission. Under the new policy long-drawn-out rate proceedings will not meet with its approval, and more hearings will be held.

Canada

SALE OF THE PRINCE ALBERT (Saskatchewan) electric light plant to Canadian Utilities, Ltd., for $875,000 has been authorized by the burgesses of that city following a vote taken January 14.

A 17½ PER CENT REDUCTION in the rate charged power consumers using electricity for manufacturing has been made by the Toronto Hydro-Electric Power Commission. It is estimated that the reduction will mean a saving of between $100,000 and $150,000 a year to manufacturers. There will be no reduction in the rate on domestic power.

THE FOURTH 20,000-HP. GENERATOR in the Grand Falls (New Brunswick) hydro-electric plant has been placed in commercial operation by the International Hydro-Electric System, a division of the International Paper & Power Company. The full installation has now been completed.

Abroad

ISSUANCE BY THE British Central Electricity Board of the South Scotland Electricity Scheme makes the ninth prepared by the commissioners. When the tenth, under consideration and concerned with the north of Scotland, is published, the whole of England, Scotland and Wales will be covered by regional schemes on the way to operation. The South Scotland scheme is somewhat different from the other schemes, the area comprised being large and the population very small. Plans include five hydro-electric stations with a total estimated capacity of 140,000 hp.

THE LONGEST HIGH-VOLTAGE SYSTEM in Newfoundland—a 66-kv., 50-mile, three-phase, steel-pole, copper line—has just been completed by the International Power & Paper Company. It runs from the 157,000-hp. Deer Lake hydro plant and will supply a maximum of 6,000 hp. to a mining company.

Coming Meetings

Pacific Coast Electrical Association—Commercial Section, Los Angeles, Feb. 5-6. K. I. Dazey, 447 Sutter St., San Francisco.

Midwest Power Engineering Conference—Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Public Utility Group, National Association of Purchasing Agents—Statler Hotel, Boston, Feb. 19 and 20. G. A. Renard, 11 Park Place, New York.

North Central Division, N.E.L.A.—Engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

American Institute of Electrical Engineers — District meeting, Pittsburgh, March 9-13. F. L. Hutchinson, 33 W. 39th St., New York.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association — Springfield, Ill., March 12 and 13. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Northwest Electric Light and Power Association — Commercial Section, Spokane, Wash., March 16-18; Engineering Section, Wenatchee, Wash., March 18-20; Accounting Section, Salt Lake City, April 13 and 14. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Southeastern Division, N.E.L.A.—Vinoy Park Hotel, St. Petersburg, Fla., April 1-3. C. M. Kilian, 508 Haas-Howell Bldg., Atlanta, Ga.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 10. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

Southwestern Geographic Division, N.E.L.A.—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Electrochemical Society — Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.

William S. Lee

President

American Institute of Electrical Engineers

EDITORIALS

L.W.W.MORROW
Editor

Support for cultural standards

RISING taxes on utilities and rising clouds of still more taxes to come cause much concern. But not all the import of taxes lies on the gloomy side. The taxes are in large part allocated to the support of our great educational system and therefore make a positive contribution to the social culture of the age.

The entire school system from kindergartens to normal schools and colleges in Alabama had to live on a budget of $3,250,000 twenty years ago. In 1929 this outlay had grown to $28,500,000 with the much more extensive and effective schools now provided. Meanwhile assessed valuation of electric utilities had grown from less than $2,000,000 to more than $76,000,000—one-third of the total utility property in the state at the present time. In turn the total utility assessed valuation is about one-fourth of that assessed on all property in the state. In this instance, then, it is evident that, very roughly, one-twelfth of the present enormous and commendable educational expenditure is being supported by taxes contributed by the electric utilities alone; and much of the balance comes from industrial and other enlivened values founded on the universal availability of electric power.

Those who are disposed to lament the omnipresent machine and look with alarm upon the unrelenting progress of the electrical age may well give heed to the direct support both afford to maintenance and advance of cultural standards. Culture does not suffer from conflict with materialism. It follows and lives on material progress. The Golden Age of Pericles and the Elizabethan era both waited for commercial supremacy. America's cultural pre-eminence and enviable diffusion of knowledge are the direct consequence of the wherewithal to foster them having arisen out of the prosperity which industrialism establishes. Our schools, colleges, poets, authors, artists and musicians are thriving on the proceeds of the steam, hydro and electric revolution. The renaissance in culture and art will find footing for its next strides in the prosperity of the just-beginning era of electrified industry and electrified habitations.

Railroad electrification and energy rates

RAILROADS and electric utilities are in the same boat as far as rates are concerned. Both are having the same difficulties in making the public and the authorities realize all the factors which enter into the cost of maintaining a utility or a railroad. It should therefore be easy for the two to understand each other when the question arises of establishing an energy rate for railroad electrification. Yet there has been an undercurrent of misunderstanding. The real reason for this seems to lie in the fact that before questions of finance can be discussed all engineering features must be agreed upon, because in the last analysis rates must be based on engineering features. The N.E.L.A. offers a forum for the utility men to discuss their own problems among themselves, and the various railroad associations offer a similar forum for the railroad men. But until now there has been no common meeting place for the two groups.

The New York Section of the A.I.E.E. is therefore to be congratulated upon having arranged a joint meeting of its power and transportation groups, where the engineering questions underlying rates were competently discussed both from the viewpoint of the utility selling energy

and from that of the railroad as a consumer. A few more such meetings should clear up all the misunderstandings in regard to engineering features, and after this is done definite understanding in regard to rates should come readily. The railroads, the utilities and the public at large are all benefited by such get-together meetings.

An embarrassing lesson in three appliances

NOTHING more stimulating to market-minded men has occurred in the electrical industry than the sales of electric clocks, ranges and refrigerators last year. Business was bad. People were not spending. It was no time to talk about luxuries. And yet three and one-half times as many clocks were sold as in the prosperous year previous, while sales of ranges and refrigerators increased 11 and 23 per cent over 1929.

It is easy enough to cite that at the close of 1930 only 4.4 per cent of American homes were cooking electrically and only 9.4 per cent owned refrigerators and only 7.3 per cent had electric clocks. But that is not the point. The interesting aspect of these figures is that these luxuries could be and were sold in this twelve months of popular discouragement and depression. It proves the salability of the merchandise. It raises the question as to whether or not electrical men should be content to gain so slowly in their growing market. If electrical appliances can be sold this way by extra efforts against such odds, can we excuse the fact that year after year in normal operations the average residence load is increased by but a scant 20 kilowatt-hours and barely keeps up with the increasing population in the growth of total wired homes?

It is just a matter of increasing man power, management and methods whether the electrical industry sells $789,634,625 worth of appliances in a year, as it did in 1930, or many times that amount. But in this vast country, if any increased progress is to be achieved, it must be made a major operation, planned and financed as the big job that it is. This fact must be faced no matter if it is embarrassing.

Network improvements aid operators

FINANCIALLY speaking, every economic aspect of electrical distribution is "on the carpet" beside the executive desk. Distribution networks are facing the same kind of cross examination as are other facilities. Many problems, of course, still remain to be settled, but the present trend of design reveals gratifying responsiveness to the needs of operating companies and of their customers.

Network transformers have become a fairly specialized class of units of late, but a wide range of dimensions is available for units of stated ratings to facilitate their installation in restricted locations without inviting trouble from the operating standpoint. Considerable progress has been made in the concentration of accessories like primary entrance and secondary terminal boxes, protectors, grounding switches and ground terminals at the transformer. Marked savings in cable runs and other material are resulting. Detachable types of air-breaker units and protector mechanisms are coming into vogue, enabling units in good order to be substituted quickly for apparatus in trouble. Special attention has been given to the accessible mounting of relays and their connections in waterproof and gas-proof boxes, and the use of flexible control cabling and sectionalization of terminal functions is following the lead of the communication engineer. Flame-proof cable is receiving attention on a larger scale, and the regulation and division of load between neighboring transformers is being more effectively studied, with a present trend toward the use of less reactance in transformers and cable circuits in equalizing such division.

It appears that 99 per cent of the 220-volt motors operated on 208-volt networks are giving satisfactory service, as is the use of 115-volt lamps on 120-volt network. Tests are being made of aluminum cable for convenience in burning off sections near faults; and some companies are installing ground switches operable from outside vaults and manholes. All in all, the progress of network engineering reveals a most helpful coordination of effort between manufacturing and operating engineers.

The challenge of oil

ABOUT five per cent electrified. That is the condition of the petroleum industry in the United States as it is seen by electric utility men of the Southwest. These men have for five or six years wrestled with this situation as individuals, and in some cases they have achieved remarkable performances in the application of central-station energy to the production, transportation and refining of petroleum.

It is true enough that progress on any broad front is but the sum of individual steps; but certainly there must be more steps if, instead of leaving each individual to walk unsupported and alone, there is to be concerted action as the result of full understanding all along the line. Such understanding appears to be in the way of realization as regards the approach of the electric utilities to service to the petroleum industry.

In order to deal with the problem of service to the oil industry the utilities will have to consider the revision of conditions in their practices that undoubtedly will affect other businesses than that of oil. Uniformity of rate and contract forms, standardizations of service conditions, if worked out successfully for application to the oil business, will certainly be applied to other industries of national scope, such, for instance, as packing, railroads and chain stores. And it will certainly do no harm for the electric utilities so to arrange their affairs that a customer will not be forced to learn a new language concerning rates and service requirements when he turns from dealing with the power company in one territory to talk to the power company in another.

The challenge to electricity in the petroleum field is provided not only by the paltry five per cent of electrification. Other percentages also demand attention. The average efficiency of oil production—that is, from power input in the form of fuel or other energy source to oil on the top of the ground—cannot be much more than fifteen per cent for the whole industry. Inventiveness and ingenuity in the application of electric power can raise this value very greatly. As a matter of fact, a new development that includes a submerged pump, but that as yet has hardly graduated from the experimental stage, will, if claims made for it are sustained, show an efficiency of about fifty per cent.

Appreciation and understanding of the problems of oil production and handling on the part of the electric utilities, which apparently are now well started from the business angle, and technical and inventive effort will surely show, in the next few years at least, a change for the better in the figures with which oil now challenges electricity.

Some specifications—a vestigial survival?

FIDO, in the routine of composing himself for the night, turns around several times on his bed, pawing and scratching at it in his revolutions. That is a vestigial habit, instinctive from the days when his wolf-like ancestor raked together a pile of leaves and twigs for comfort in his slumber. The suspicion will not down that no better reason than the dog might give for his rotary exercise can be advanced for certain of the specifications included in some purchase orders.

Frequently the inclusion of specifications is merely a part of the ritual of order writing. Too frequently is the basis for inspection omitted. Of course, if material or equipment that is bought on specification should go "haywire" during operation, from inherent fault, then the buyer may recover from the seller. But the fault must be proved to be inherent, not one caused since the purchase. That is none too easy if the purchase was made several years before. Furthermore, a fault disclosed by operation usually does damage in bringing itself to notice, and although there may be recovery for the fault itself, it will be extremely difficult to collect for the damage it caused. It is much better to find the fault before it has a chance to advertise, perhaps violently, its presence in operation.

The only way to ascertain whether goods purchased are in conformity with the specifications is to inspect them and find out. The time to inspect is before the bill is paid. Inspection of purchases must be a regular organized function in charge of responsible men. Only in this way can purchase by specification be more than a futile gesture, a vestigial habit.

What Shall Be the Price for Railroad Power?

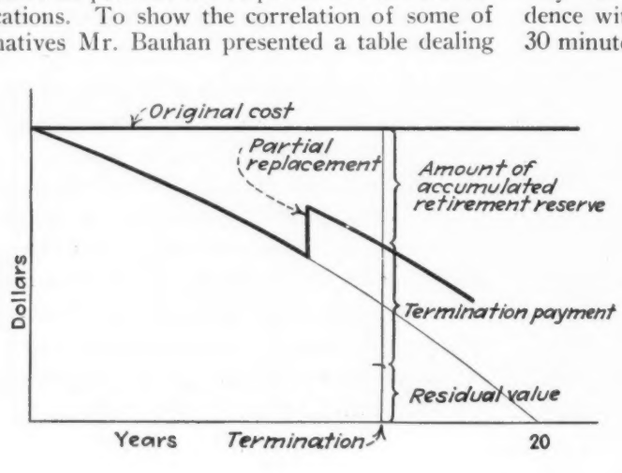
THE effects of railroad load factors, the billing demand interval, diversity with respect to time and location of the railroad load (both independently and with regard to other utility loads), return on investment in special facilities and recovery of investment residuals on termination of the contract are being canvassed more actively because of the accelerated electrification program now under way. These factors underlying the contractual provisions governing the purchase of power by railroads from power utilities were aired at a recent joint meeting of the power and transportation groups of the New York Section, A.I.E.E.

In order to reconcile utility costs with equitable revenue from the railroads it has become common practice to center the charges about a stipulated load factor incorporated in the contract as a guarantee. The effect is to make the revenue constant for load factors below the stipulated value. A question then arises in connection with load factors in excess of that stipulated value. A perfect contractual clause would result in parallelism of the cost and recovery curves. Alex E. Bauhan, interconnection engineer of Public Service Gas & Electric Company, said that there is no difficulty in wording such a clause nor difficulty in its application. The difficulty comes in maintaining equity for both parties when costs change for the utility and traffic conditions change the railroad's load factor, both in unanticipated manner.

More specifically, he pointed out the influence of the billing demand basis. Once the requisite investment has been determined by the utility the methods of recovering return upon it amount to rate artifices, predicated principally upon ascertaining the demand and then billing on that basis. A wide variety of metering and billing bases may be devised to produce the requisite income for capacity allocations. To show the correlation of some of these alternatives Mr. Bauhan presented a table dealing with assumed conditions for commuting and trunk line electrification, all being referred to the fifteen-minute demand as a standard of reference. The metered demand for each of these assumed load curves will bear a definite ratio to the fifteen-minute registration and, to recover the necessary capacity revenue, the billed demand must be adjusted in inverse ratio. Of course the longer the demand period the less in general the average demand recorded. The ratio of decrease is tabulated for the hypothecated load curves based on experience with railroad demands. The contract clauses which aim at equity in this field are not wholly perfected. Incidentally, this table serves to show the risk of comparison of rates under which utility power is sold to railroads unless the full details of load characteristics and the billing demand are simultaneously considered.

What peak shall fix the rate?

Diversity is another significant element of contractual negotiation. Peak responsibility has lost in favor in utility circles in dealing with their familiar residential, commercial and industrial loads. Similarly the out-of-pocket costs of the power company for generation are more definitely associated with the actual railroad peak than with the instantaneous contribution to the system peak. The savings from the resulting diversity are contemplated by the utility in fixing the demand charge not built directly on the peak responsibility concept. Once the charge has been fixed some contractual provision must be considered to guard against insufficient recovery on capacity investment in case the railroad adopts other sources of supply to eke out its peak and thus reduces its demand payments to the original supplier. On the other hand, railroad tonnage and schedules may well increase and the time of peak shift to coincidence with the power system peak. In fact, a shift of 30 minutes in the time of existing suburban traffic peaks



Basis of charge on termination of contract

The power purchaser is contractually obligated to pay the supplier the actual cost of the interconnecting facilities less the sinking fund accumulated and the residual value for other applications of the relinquished facilities. The termination charge is here made in the form of a 2½ per cent annuity (compounded at 5 per cent) reduced by a 3 per cent sinking fund (likewise compounded at 5 per cent).

Relation of Demands Based on Different Intervals and Demand Charges for a Specific Case

Billing Demand Basis	Suburban Service Billing Demand	Suburban Service Demand Charge	Trunk Line—All Services Billing Demand	Trunk Line—All Services Demand Charge
Annual				
Maximum 15-minute	1.00	1.00	1.00	1.00
Maximum 30-minute	0.95	1.05	0.98	1.02
Maximum 60-minute	0.89	1.12	0.96	1.04
Maximum clock hour	0.71	1.41	0.95	1.05
Average of three maximum clock hours	0.69	1.45	0.90	1.11
Monthly				
Maximum 15-minute	0.88	1.13	0.89	1.12
Maximum 60-minute	0.79	1.27	0.85	1.18
Maximum clock hour	0.63	1.59	0.85	1.18
Average of three maximum clock hours	0.61	1.64	0.80	1.25
Average of daily maximum five minutes	0.81	1.23	0.83	1.20

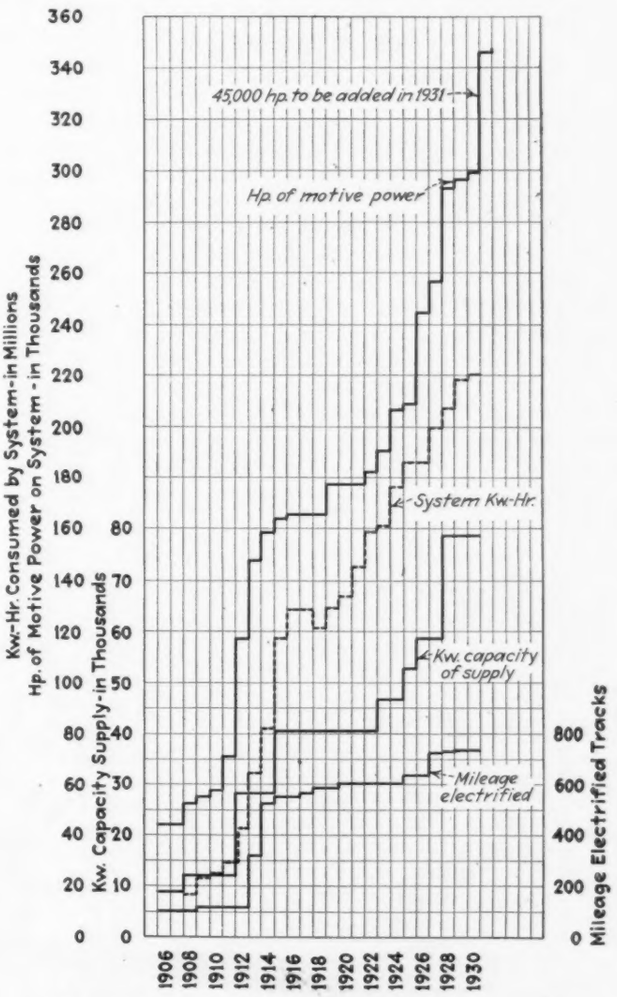
in the metropolitan area would entail nearly double generating costs to the utilities supplying railroad power. Prevailing contracts inadequately provide for these exigencies arising out of controllable or uncontrollable changes in diversity. Remedies based on prescriptive limitations on the use of auxiliary power sources, the area in which the power shall be used, and classification of railroad usages have not been found effective. They restrict freedom of action, prevent most economical utilization and circumscribe emergency measures in case of power supply failure or unusual traffic. In Mr. Bauhan's opinion contracts will ultimately be devised to correlate more explicitly the factors of demand, diversity and peak responsibility.

Many of the facilities are special

Many of the facilities provided for conversion and delivery of railroad power are special in that they are only in part adaptable to other types of power requirements. Further, the initial installation and the progressive enlargements must be predicated on subsequent requirements of the railroad. Low initial requirements of the railroad must be reconciled with relatively high initial commitments by the power vendor. Averaging is a common resort in this connection to keep revenues in line with costs. On the other hand, this difficulty is obviated if agreement can be reached on fixed annual rental for the facilities provided, independently of metered and billed demands. But termination of the contract is always to be contemplated in the contract, even if not a likely eventuality. In most cases these railroad-power contract clauses are still too crude to insure perfect equity. Intercompany dealings between power utilities have, however, led to the adoption of clauses which make allowance for other feasible uses of the special equipment released and then assess, by way of an annuity, that portion of the balance not accumulated by sinking fund procedure in the retirement reserve.

Attention was called by J. H. Coffin of Jackson & Moreland to the shift in time and location of the railroad load as the fleet of commuter trains move in during the morning rush and out during the evening on the Lackawanna system. Power is being obtained from three different utilities in three distinct zones of the electrification. Possible outage of one source immediately raises the question of the assessment for excess demand imposed on the other sources. To the railroad it appears that credit for the outage period at the failing source should compensate for the excess payments for the other supplies and some additional consideration given to the decreased efficiency and poorer regulation of voltage on the railroad system having to transfer the deficiency. It was Mr. Coffin's opinion that the three companies should co-operate in framing a joint contract to cover the demand aspects under such circumstances.

Sidney Withington of the New Haven road reviewed the growth of electrification on that road since it bought the estate of Edwin Booth, the famed actor, at Cos Cob and erected in 1906 its own power house on that site because no utility was in a position to undertake the railroad traction load. Extensions have been made to that plant from time to time, but meanwhile power contracts have been negotiated with companies of the New York Edison group, the Connecticut Light & Power Company (at Devon), the Connecticut Company (the New Haven's trolley subsidiary, at New Haven), and also an emergency connection with the Pennsylvania Railroad on the Bayside tie. The latter three are all variable-ratio motor-generator sets, involving a total of four



A quarter century of electrification growth

The New Haven's 11,000-volt system has more than 700 miles of electrified track served by a third of a million horsepower in motive equipment. Some of the original locomotives have run nearly 2,000,000 miles; they are on their fifth round trip to the moon.

5,000-kva. units. The variable-ratio feature has a direct bearing on contractual conformity because it allows a predetermined load to be carried through each unit regardless of the load characteristics on either side or the phase relations or relative frequency of the two interconnected systems. The New Haven road considers the Cos Cob plant to be the backbone of its power supply; it is strategically situated close to the load center. The auxiliary supplies can carry a major part of the load in case of complete severance of the transmission facilities. In purchasing utility power, however, the railroad reserves the unconditional right to utilize the power wherever it sees fit regardless of the location of the point of supply.

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Pole-Top Switches Redesigned for All-Wood Construction*

By F. E. ANDREWS

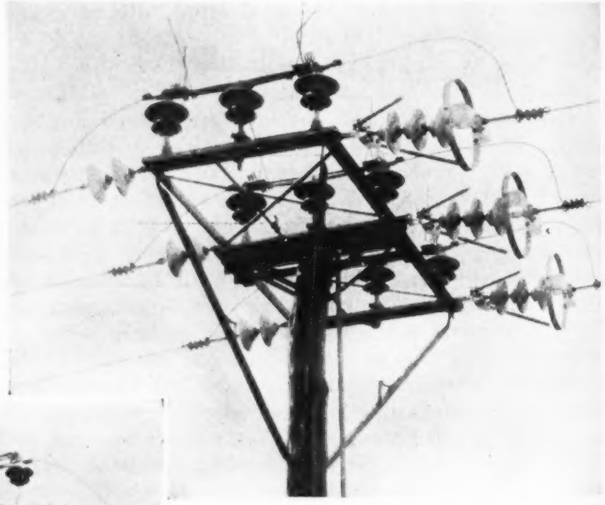
Public Service Company of Northern Illinois, Chicago, Ill.

Following the adoption of all wood 33-kv. line construction on the system of the Public Service Company of Northern Illinois a problem arose in the design of pole-top switches for use on these lines. Investigation showed that the performance of pole-top switches on the previous type of line construction was very unsatisfactory. With the co-operation of several switch manufacturers pole-top switches have been designed in conformity with the new line construction. The arrangement of the switch bases for the individual phases conforms to the configuration of the ordinary pole top with the new construction. Wood interconnecting mechanisms are used. With switches built in this manner it is expected that their performance will be equivalent to that of the new line construction.

For switches of the older type that were retained in service the practice of installing fused arcing rings on the dead-end insulators has been adopted. The fused arcing ring assembly consists of two parts, the fuse holder and the ring; the ring is attached to the line end of the dead-end insulators and is energized at line potential and the fuse-holder assembly is attached to the grounded switch-frame end of the strain insulators. Each assembly holds two fuses that project at an angle from the holder such that a 9-in. air gap is secured between the top of the fuses and the rings. This gap has been selected to break down under lightning impulse at a voltage somewhat less than that required to sparkover the 55-kv. switch insulator.

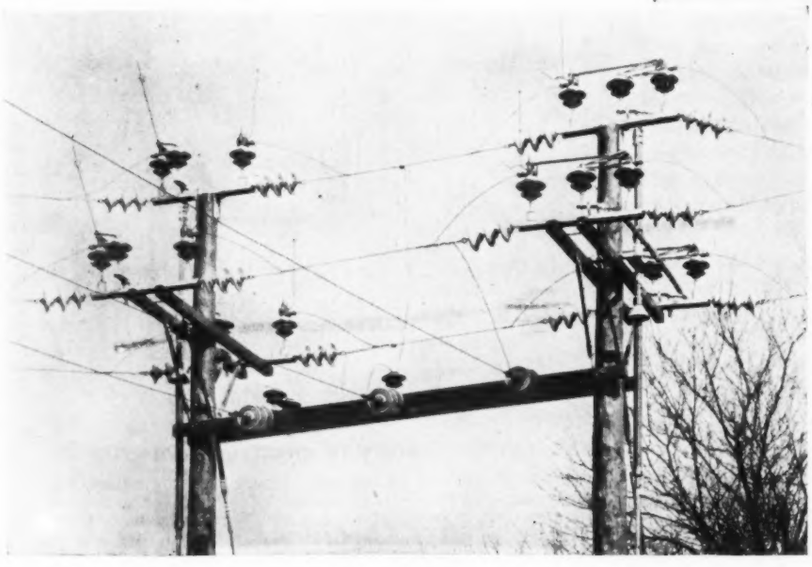
Eight installations of the fused arcing rings on pole-stop switches have been in service since about July, 1930, at locations selected because of their susceptibility to lightning flashovers. One or more fuse operations have occurred at seven of these locations. With one exception the record has been perfect, and this exception was a result of incorrect adjustment of the air gap. A correct operation occurred after the proper adjustment had been made. The fuse used is of the expulsion type manufactured by the General Electric Company. It appears, therefore, that the use of the fused arcing ring provides a satisfactory solution of the problem of lightning flashovers on existing pole-top switches at an expense materially less than that of replacing or rebuilding the switches.

*Abstracted from paper presented at fall meeting, 1930, of Engineering Section, Great Lakes Division, N.E.L.A.



Revised for better lightning protection

Fused arcing rings on old switches save money over new installations for added protection against flashover.



Switch for all-wood pole top

Wood between phases and also between switch and ground.

Experiences with Lightning

1929 operating records of 1,200 miles of 132-kv. line
Direct and induced strokes occur
Grading shields protect conductors; ground wires effective

FOR a five-year period accurate field observations of lightning effects have been made on the extended 132-kv. lines of the American Gas & Eiectric Company. The latest data cover the 1929 experiences and were presented at the midwinter A.I.E.E. meeting by Philip Sporn.

The lightning outages over the entire system were 248, out of a total of 360. Lightning accounted for 69 per cent of the total outages. As compared to 1928 there were 141 per cent more storms in 1929 on the system and more miles of line were exposed.

Comparative line outages due to lightning during 1928 and 1929 are given in Table I and indicate in every case the more severe lightning storm conditions over the system as a whole. As a result of the studies the following interesting conclusions are made by Mr. Sporn:

1. *Reliability of Two-Circuit Lines.*—Two-circuit lines when installed in vertical configuration on the same towers enhance the reliability of the system in a greater proportion than the mere doubling of the circuits. Experience definitely indicates that the likelihood of both circuits tripping out is comparatively small, only 16 to 29½ per cent of the cases of the trip-outs involving both circuits. There appears a likelihood that this percentage can be reduced by higher speed switching.

2. *Effectiveness of Ground Wires.*—The only line equipped with two ground wires, Windsor-Canton, had 3.6 outages per hundred miles of line per year. The only line not equipped with a ground wire, Logan-Sprigg, had an outage record of 76. The Turner-Logan line, operating with one ground wire in 1929, had 37.4 outages per hundred miles of line per year, and in 1928, when no ground wires had been installed, had an actual outage of 32.3; this figure, corrected on the basis of the more severe lightning conditions in 1929, becomes 45.3 outages per hundred miles of line for the no-ground-wire conditions.

This shows clearly the benefits of one ground wire and indicates definitely that two ground wires are more beneficial than one. It is, of course, necessary to keep in mind that the Windsor-Canton line is built with a short span and therefore at a low height above ground, and is, moreover, located in a territory where lightning conditions are not as severe as on other parts of the system.

3. *Effectiveness of Grading Shields.*—Grading shields have very little effect on the lightning outages of these 132-kv. lines, neither increasing nor decreasing the number of outages. On the other hand, they definitely limit the damage to insulators and conductors; further, the amount of cascading is reduced. The cascaded strings over the entire system (and most of the system is equipped with grading shields) were 23 per cent of the total number of towers flashed over. Those lines that had grading shields installed recorded only 21 per cent, but the lines that had no shields had a record of 70 per cent. This is a very striking indication of the benefit rendered by grading shields.

4. *Lightning Storm Data.*—No reliable interpretation of performance of lines under lightning is possible, or is

Table I—Line Outages per 100 Miles of Line per Year

	1929	1928	1929 Per Cent of 1928
All lines	21.6	13.5	160
Two-circuit lines	23.3	17.7	136
One-circuit line..	17.8	10.0	178
With grading shields	20.8	13.8	151
Without grading shields	13.3*	8.1	165
Average	....	....	158

Line outages per 100 miles of line per year on four new lines in operation in 1929, 7.3.

*Exclusive of Windsor-Canton and Logan-Sprigg lines.

Table II—Lightning Outages 1929

	Line Outages			
	Total	Sleet	Lightning	Per Cent Lightning
Fort Wayne-Marion Muncie	26	19	6	23.1
Glen Lyn-Roanoke	32	..	30	93.6
Glen Lyn-Switchback	12	..	9	75.0
Lima-Fort Wayne	0	..	0	..
Limo-Fostoria	7	..	4	57.2
Logan-Sprigg	20	..	16	80.0
Marion-Kokomo	3	..	1	33.3
Philo-Canton	27	..	11	40.7
Philo-Crooksville	8	1	1	12.5
Philo-Turner	40	..	27	67.5
Roanoke-Danville	36	..	32	89.0
Roanoke-Reusens	16	..	16	100.0
Saltville-Kingsport	13	..	13	100.0
South Bend-Michigan City	13	..	19	69.2
Switchback-Logan	22	..	20	90.8
Switchback-Saltville	17	..	16	94.0
Turner-Cabin Creek	9	..	7	77.8
Turner-Logan	18	..	15	83.3
Twin Branch-Fort Wayne	13	2	7	53.8
Twin Branch-South Bend	6	3	3	50.0
Windsor-Canton	4	..	2	50.0
Philo-Howard	18	11*	3	16.6
Totals	360	36	248	69.0

*Dancing conductors.

Per cent lightning outages, 69.

Per cent lightning outages (omitting sleet and dancing conductors), 76.6.

Table III—Outages on Two-Circuit Lines

	Miles	Outages: One Line	Outages: Two Line	Per Cent Two Line
Fort Wayne-Marion-Muncie	80.6	5	1	16.7
Glen Lyn-Roanoke	65.0	19	11	36.7
Glen Lyn-Switchback	30.0	6	3	33.3
Philo-Canton	73.0	9	2	18.2
Philo-Turner	161.	24	3	11.1
Roanoke-Reusens	43.0	11	5	31.2
Switchback-Logan	50.0	11	9	45.0
Turner-Cabin Creek	23.6	4	3	42.8
Turner-Logan	40.2	11	4	26.7
Twin Branch-South Bend	4.9	1	2	66.7
Windsor-Canton	55.0	2	0	0.0
	626.3	103	43	
Per cent outages		70.5	29.5	

Table IV—Comparison of Damage to Line With and Without Ring and Horn

Philo-South Point-Turner Line (From Tower Climbing Inspection)

Tower Location with	With Ring and Horn	Without Ring and Horn
Cascaded insulators	5	16*
Strands burned in two in wire	0	4†
Number of flashovers	11	20
Blistered strands	2	4‡
Lightning outages	13	14
Length of line (miles)	152.6	168
Outages per 100 miles of circuit per year	8.5	8.3

*Five cases of badly stripped insulators.

†In addition to cases with strands burned in two.

‡Replaced about 50 ft. of conductor each side of tower, in one case.

of real value, without an accompanying record of lightning storm conditions during the particular time discussed. Conclusions gravely misleading will otherwise be made.

5. *Line Conductors Involved in Flashovers.*—Records of physical inspection and relay target indications show that in trip-outs due to lightning, all three phases are involved in from 4.7 to 5.8 per cent of the cases. In 44.2 to 45.2 per cent the top and middle conductors only are involved. In 42.8 to 44.3 per cent the bottom and middle conductors are involved. It is also shown that in from 73.2 to 64.2 per cent only one phase is involved. It is interesting to note that the number of cases where either the middle or bottom conductors only were involved is almost equal to the number of cases in which the top conductors only were involved.

This analysis indicates very strongly that both direct and induced strokes are of vital importance and play a great part in the performance of this 132-kv. network.

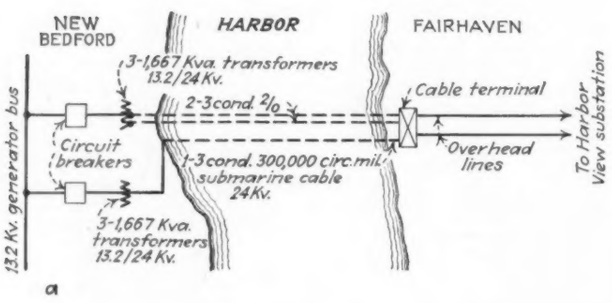
6. *Effect of Tower Footing Resistance on Lightning Flashover.*—Detailed data on the tower footing resistances on four 132-kv. lines do not show any tendency for lightning flashovers to concentrate on towers of high-footing resistance in preference to those having low-footing resistance. In fact, whether lightning strikes a tower with low- or high-footing resistance seems to be, from these data, a matter of chance. Flashed-over towers were observed where the footing resistance varied from 1.5 to over 250 ohms.

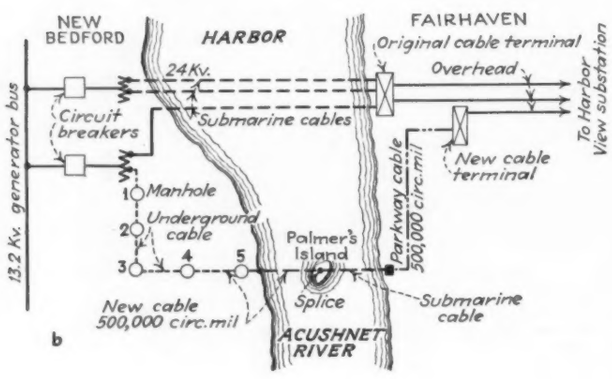
▼

Multi-Type Feeder Serves Expanding Loads

Increasing loads in and beyond the Fairhaven district of the New Bedford Gas & Edison Light Company required additional feeder facilities for the transmission of energy from the Cannon Street steam plant. A study showed that a 500,000-circ.mil feeder added to two existing feeders would meet present demands for 24-kv. energy at Harbor View and provide future capacity for 13.2-kv. transmission direct from the generator bus

Former, present and future installations

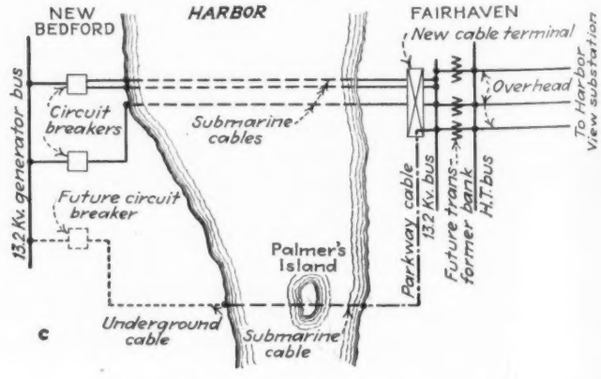




(a) The original installation of two circuits supplied energy at 24 kv. through two submarine cables crossing to the Fairhaven district. Step-up transformers were located at the generating station on the New Bedford side of the harbor.

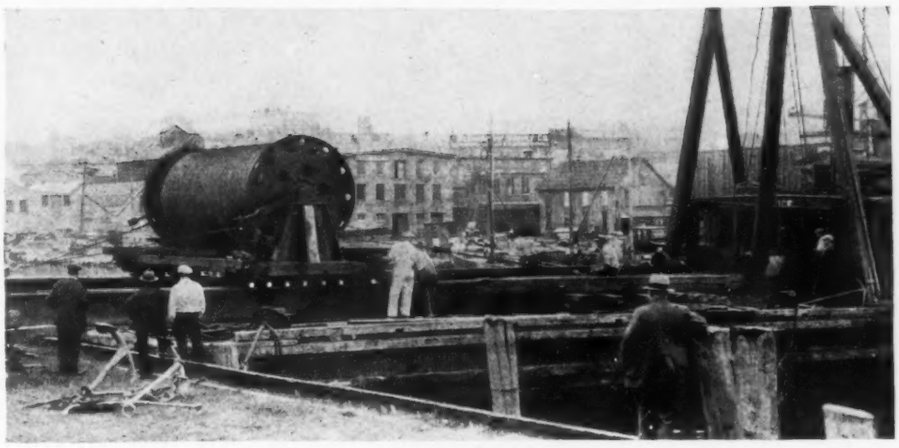
(b) In the present installation the original cable crossing has been left in service and a new feeder with underground, submarine, parkway and aerial sections run from one transformer bank on the New Bedford side of the harbor to the Harbor View substation on the Fairhaven side. All cables operate at 24 kv., but provision was not made to connect the new feeder with the upper transformer bank because of the temporary character of the present hook-up.

(c) If it is advisable later to transmit energy at generated voltage from the Cannon Street station to Harbor View substation, the transformer banks on the New Bedford side of the harbor will be removed and the three feeder circuits connected in parallel on the main bus. Space does not permit building a large step-up transformer substation on the station property.



Unusually large reels were employed in laying the submarine section

A typical reel was 18 ft. long and weighed, with 2,755 ft. of cable, 74 000 lb. Reels were handled f·om flat car to lighter by rolling them on skids over I-beams.



across the harbor in case it becomes advisable to do away with the transformer banks on the New Bedford side and concentrate step-up transformer units at Fairhaven. The new feeder was therefore installed, but to avoid anchorage interference, it was laid across the waterway below the original cable crossing. This necessitated runs of an underground section on the New Bedford side 1,500 ft. long, a submarine section 4,600 ft. long, a parkway section 1,400 ft. long on the Fairhaven side and an open wire section 2,200 ft. long from the terminus of the parkway section to the Harbor View substation. These three types of cable construction, appearing within a run of about 1½ miles, are of similar design and were furnished by the Okonite-Callender Cable Company, Inc., under the following specifications:

Underground Section—Three-conductor, sector type cable with 20/64-in. wood pulp paper insulation, impregnated, and 9/64-in. lead sheath. Type H cable with 0.004-in. monel-metal tape. Outside diameter, 3.16 in.; weight per ft., 14.6 lb.

Submarine Section—Same as above, with addition of jute serving and No. 4 B.W.G. galvanized steel armor wire. Outside diameter, 3.75 in.; weight per ft., 21.8 lb.

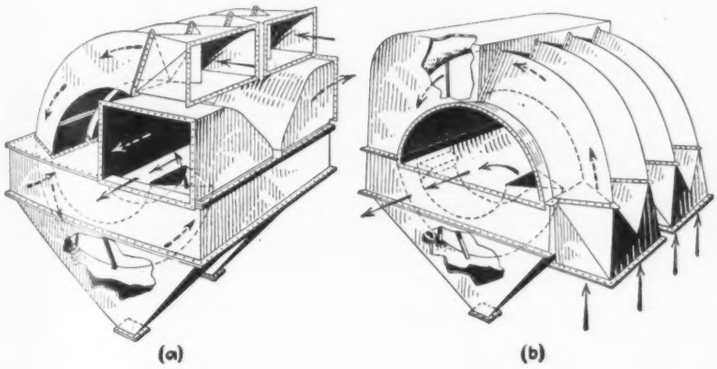
Parkway Section—Same as underground with addition of jute serving, two layers of 0.033-in. steel tape laid overlapping with jute and asphaltum covering. Outside diameter, 3.67 in.; weight per ft., 17.6 lb.

The cost of installing the new cable, including underground, submarine and parkway sections, dredging, excavation, filling, joints, etc., was about $50,000, of which $10,700 represented dredging to an average trench depth of 5 ft. The trench for the submarine section was left open for economy in first cost and to facilitate maintenance. The underground conduit section utilized six 4-in. fiber ducts and costs about $6,000 exclusive of the cable. Five concrete manholes were provided in this section. Between Palmers Island and the Fairhaven shore it was feasible to lay the new submarine cable in the trench of the older cables for a distance of about 600 ft., and this was done further to save initial costs.

Besides five manhole joints in the underground run, three joints were required for the lead-sheathed cable, two trifurcated joints at the terminal of the overhead line and six standard underground single-conductor terminals. All the joints are of the paper-insulated, pencil type, a soft compound being used except at the trifurcated joints, where a stiffer filling compound was applied. The dredging depth was about 35 ft.

The aerial section on the Fairhaven side is composed of a No. 4/0 bare copper circuit on pin-type insulators, with 40-ft. poles from 100 to 113 ft. apart. An upper four-pin arm carries the circuit on flat spacing. If a second aerial circuit is later needed a two-pin arm can be easily added. The phases are Y-connected and grounded at terminals, but no ground wire is installed on this section. The cost of installing the overhead section, exclusive of right-of-way land, was about $3,600.

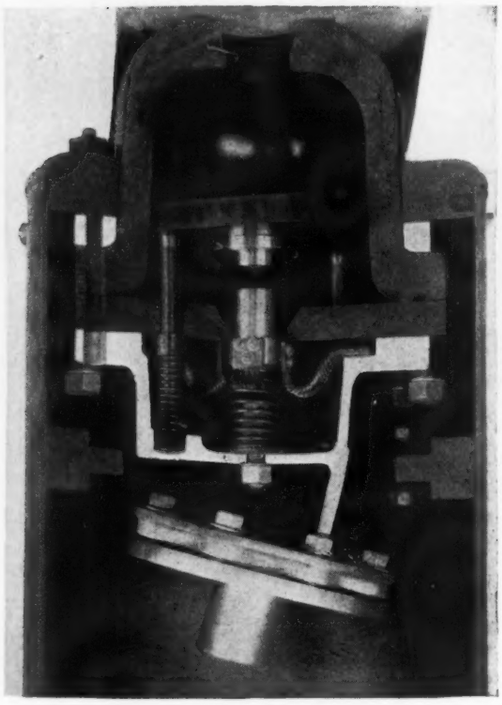
Cyclonic Grit Catchers Remove Dust from Flue Gases



Reduction of atmospheric pollution by flue dust may be effected in the vicinity of coal-burning steam plants by cyclonic grit catchers, according to a recent article in the *Electrical Review* (London). These grit catchers are installed on the flue side of the induced-draft fans. They trap between 90 and 95 per cent of the flue dust. The solid matter in the gases is thrown toward the periphery of the circular chamber and drops into a chamber beneath—(a) shows the type of grit catcher used in stoker-fired plants, while (b) is for pulverized fuel plants.

Circuit Breaker Progress

Field tests at 1,750,000 kva. fix new rating limits.
Several new breakers developed using novel ideas.
Standardization still distant.



Explosion chamber assembly for new oil blast circuit breaker

(Spurck and Strang)

CIRCUIT breakers are in a rapid state of change, according to the papers presented at the mid-winter A.I.E.E. meeting. These papers record more progress than has been had in many years. They show better breaker performance, new designs of commercial breakers and new research developments that are promising, but they do not indicate that commercial standardization is near. Though the art is making progress, it may well be said that the commercial situation will be even more chaotic in the future. This is the temporary penalty for making new developments.

Four papers on circuit breakers treated in general of:

1. Field tests on high-voltage breakers.
2. Improved designs of present type breakers.
3. Novel ideas for new types of breakers.

Probably the most immediately useful data were connected with field tests of General Electric explosion-chamber breakers made at the Philo station of the American Gas & Electric Company. Power magnitudes of 1,750,000 kva. at 140,000 volts were available for breaker tests—values far in excess of those available in the past.

These tests were made in groups and at a recovery voltage rate up to 2,400 volts per microsecond. They showed that:

1. Breakers rated up to 2,500,000 kva. at 150,000 volts could be relied upon to perform satisfactorily.
2. Rate of recovery voltage has an important bearing on breaker performance.
3. Time for breaker operation could be depended upon within predetermined limits fixed by system stability and relaying.
4. Improved designs and better mechanical construction would make the breakers even more reliable.
5. It may be possible to change the present OCO rating to one more nearly simulated in actual system requirements; i.e., more severe duty specifications.

Both standard types and the new oil-blast types of explosion chamber breakers were tested, and while, in general, the performance of both types was satisfactory, the new oil blast type proved most promising as a new achievement in the art.

These tests have a very reassuring influence upon power system design and operation. They show that high-voltage breakers can be counted upon to operate under present severe service requirements and yet that no maximum values in capacity can be set as limits for breaker developments. Philip Sporn and H. P.

Field Test Comparison of Explosion-Chamber Circuit Breakers

(Spurck and Strang)

Butt Contacts

Lines Connected to Bus	Calculated Volts per Microsecond	No. of Tests	Arc Duration (Cycles Avg.)	Arc Length (In. Avg.)
3	270	17	6.2	15.5
1	600	4	7.1	17.0
0	2,400	7	15.0	24.5
Total 28 tests, average			8.6	18.0

Oil Blast Contacts

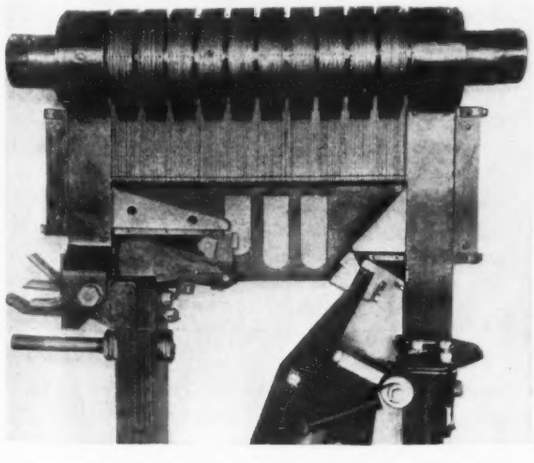
Lines Connected to Bus	Calculated Volts per Microsecond	No. of Tests	Arc Duration (Cycles Avg.)	Arc Length (In. Avg.)
3	270	15	2.6	4.5
1	600	9	3.7	7.1
0	2,400	16	4.1	8.8
Total 40 tests, average			3.5	6.8

St. Clair discussed the tests from the point of view of utility engineers in their paper and R. M. Spurck and H. E. Strang reported the details of the tests and discussed the results from the point of view of breaker engineers.

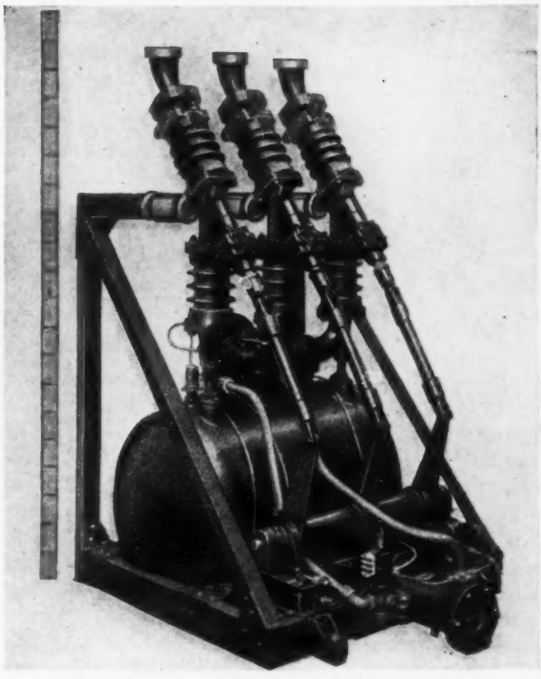
A splendid new breaker development was recorded in the paper of D. C. Prince and W. F. Skeats. This is the oil-blast type of explosion-chamber breaker. This breaker is based upon forcing solid oil in the arc gap at the time the current is zero, thus giving a very high dielectric strength and preventing further arc formation. An explosion chamber with its contact mechanism is so designed as to time and pressure that at the normal voltage recovery rates the oil pressure on the chamber is converted into kinetic energy in the throat of the chamber to force a solid stream of oil into the arc space and thus interrupt the circuit. Comparative tests with standard explosion-chamber types show that arc lengths are very much less with the new design.

Deïon developments and comments on many new types of breakers made a fine paper for J. B. MacNeill. He reported Deïon breakers rated 500,000 kva. at 15,000 volts in service more than a year and a recent construction rated 1,500,000 kva. at 15,000 volts. In his opinion there is no current limitation to the Deïon, but insulating material limitations make it advisable to use this type of breaker for 25,000 volts and under in indoor service at present. New designs of deïonizing chambers with independent chamber venting are improvements in this type of breaker. He also reported that Deïon grids are now available for all breakers over 25 kv. up to 2,500,000 kva. For average circuits 10,000 volts can be opened per inch of break distance on a single break per pole and 20,000 volts per inch of lift rod movement with two breaks per pole. Arc energy is reduced, on an average, to 7 to 10 per cent of that with usual open-break devices. One of the most interesting parts of the paper by Mr. MacNeill deals with new ideas for breakers. Some of these, with his comments are as follows:

(a) *Compressed Gas.*—A.E.G. of Germany. Air or carbon dioxide at about 90 lb. pressure is injected in the arc path. Many of these breakers are in operation on 6-kv., 10-kv. and 30-kv. circuits up to 500,000 kva.



A 500,000-kva. Deïon circuit breaker for 15-kv. service
(MacNeill)



Compressed gas circuit breaker, 600 amp., 10 kv., pneumatically operated
(MacNeill)

A disadvantage is the unreliability of air supply valves and supply and complicated mechanism. Insulation limitations hold them to low-voltage service.

(b) *Expansion Breaker With Water.*—Siemens-Schuckert of Germany. This breaker utilizes water and the principle of temperature decrease to cause ions to become inert. Adiabatic expansion of gases in an inner arc chamber through a throat into an outer chamber causes the temperature of the gas to decrease and a corresponding moisture condensation in the arc stream which reduces electron movements and raises dielectric strength.

(c) *Vacuum Breaker.*—Several research agencies have attempted to develop a commercial vacuum breaker. It has not proved feasible to get the high vacuum or to maintain it for high capacity breakers. It may be used on very high-voltage circuits.

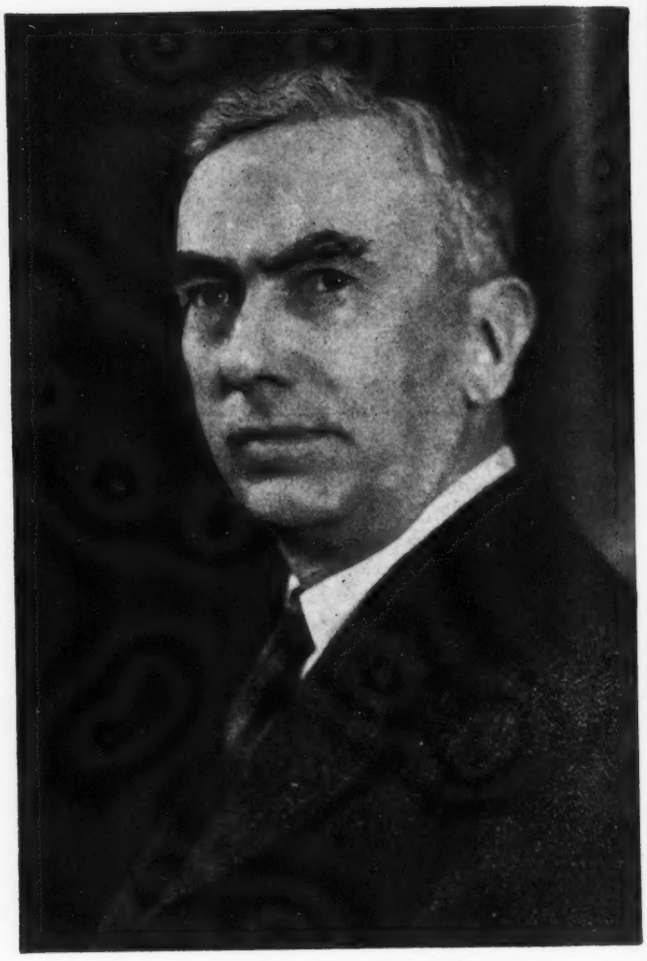
(d) *"X" Breaker.*—Siemens-Schuckert of Germany. Utilizes resistance liquids in which contacts are immersed. Not yet of commercial significance.

Conclusions

A study of these papers and of the discussion at the meeting leads to the following conclusions:

1. Nothing gives evidence of replacing the oil breaker for high-voltage, high-capacity circuits.
2. Several promising types of oil-less breakers are available or under development for low-voltage circuits.
3. Limitations in insulating materials are the greatest handicap to the development of high-voltage, high-capacity breakers.
4. Present designs of breakers are being improved greatly.
5. Research developments in the breaker art were never more active or more promising.

In recognition of "his contributions to radio broadcasting and short-wave radio transmission" the American Institute of Electrical Engineers has awarded to Mr. Conrad the Edison Medal for "meritorious achievement in electrical science, electrical engineering, or the electrical arts."



Edison Award

to

Frank Conrad

Assistant Chief Engineer
Westinghouse Electric & Manufacturing Company

Inductive Co-ordination a Notable Achievement

Symposium at A.I.E.E. convention summarizes ten-year program of industry conciliation and professional amity.

Some problems solved, some have solved themselves, others are being created by present trends in both fields.

System grounding the source of many unsolved problems.

High-speed relaying and circuit interruption offer a welcome prospect.

A REMARKABLE thing has been happening in an undemonstrative manner in the field of electrical enterprise where power and communication are thrown into contact. The contacts amount to an enormous number of proximities in the highways and byways where both groups strive to render indispensable services to the same populace. Ten years ago the contacts were headed straight for combat at a distressingly increasing number of points. Court cases hardly reflected the degree of animosity that permeated many of the inconclusive negotiations. If nothing had been done about it we would have had the spectacle of two branches of one embracive profession at loggerheads, with the innocent bystanding public losing respect for both of them and the profession as a whole.

The remarkable thing is that all this was foreseen and forestalled. The legal conflicts were abruptly terminated nearly nine years ago, and since then a quiet but marvelously effective co-ordinative study has been in progress to lay the sound foundation for orderly advance of both services with maximum economic saving to those who ultimately pay for both services.

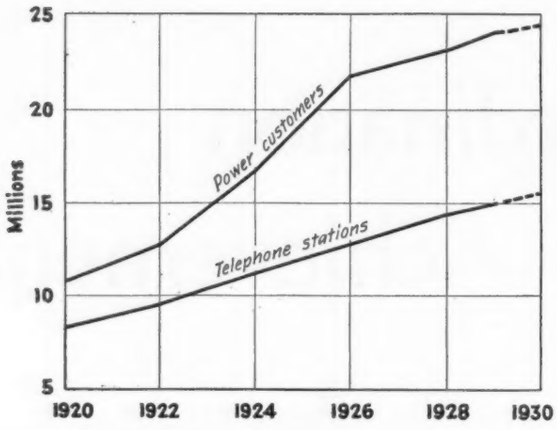
Various reports of a policy and technical nature have been published by the joint group, which was instituted to alleviate the conditions and assure a conciliatory environment for the future. The past pronouncements have come through industry channels. This week's meeting of the American Institute of Electrical Engineers provided an excellent vehicle for an unbiased professional survey of the factors in both fields which offer chances for dispute, the solutions which have been found and the problems still unsolved, and others being created or vanishing as a result of trends in both fields.

Two members of the joint general committee of the National Electric Light Association and Bell Telephone System contributed remarks of a broad policy character to reveal the atmosphere in which the technical experts have been accommodating their differences. R. F. Pack, vice-president and general manager of Northern States Power Company, in opening the symposium reviewed the origin of the conciliatory program and said that a first step was to urge power and telephone companies to substitute negotiation for court and commission proceedings. Within a year thereafter "the whole spirit of relations between the telephone and power interests had been completely changed from one of friction, distrust, suspicion, and even of enmity, to one of confidence, good will and a desire on the part of both to co-operate. Today inductive co-ordination as between the Bell Telephone System and the power companies is no longer a problem, but only a routine, day-to-day job of co-operatively continuing research work and developing the art of both systems to eliminate, as far as possible, causes for inductive interference." At no time was there "compromising on principles, nor bargaining across a table; we have had always before us a clear recognition of the problem of the other side and a mutual admission of the fact that the other system must live and that the primary interest is the public's and that the public must efficiently and economically be served by both utilities."

Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Company, emphasized the fundamentals which had brought about the present satisfactory situation. First he stressed the value in "getting together and getting acquainted, to the end that frank and friendly discussion will be promoted and misunderstandings avoided. Second is the continued development of technical information for the co-ordination of power and communication systems adequate to keep pace with the rapid amplification and growth of these two services. Third is a desire on the part of the companies concerned to work out each case in accordance with the best over-all engineering solution, as though both utilities were under the same management.

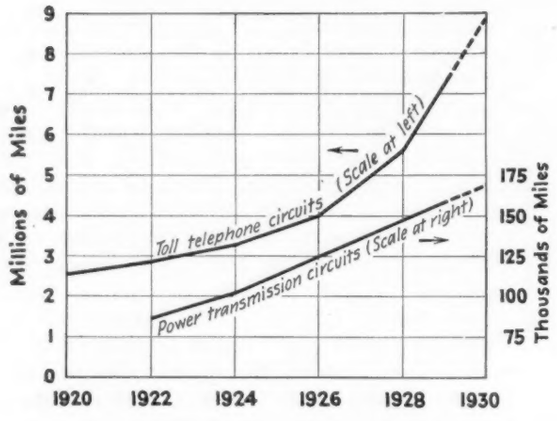
Co-ordination affected by individual trends

Entirely aside from co-ordinative measures, a survey has been made of the influence upon the co-ordination program of the individual trends in each of the indus-



Electrical growth multiplies proximities and exposures

Telephone stations have increased 88 per cent and electrical energy sales 127 per cent in ten years.



Toll circuits increase faster than power transmission lines

tries.* One of the most fundamental and far reaching of those in the telephone field is the conversion from manual to dial system operation. When present plans are completed this will result in the operation of approximately 80 per cent of the telephones of the Bell system on a dial basis. This entails a trend toward greater concentration of central office equipment in one building, but neither of these changes affects the co-ordination problem in a material way. Concentration of circuits in a single cable is of great assistance, however, by reducing the number of routes for which co-ordination must be effected. The sheath, the twisting of the pairs, the high degree of balance with respect to ground and the mutual shielding practically prevent noise currents from extraneous electrical sources. A telephone toll cable with its associated equipment costs about the same per mile as a twin-circuit power line of the 100-kv. class; the consequent resort to private right-of-way for such important telephone cables keeps them off the highways and alleviates the co-ordination situation. The susceptiveness to noise induction is so greatly reduced that low-frequency induction generally becomes the limiting factor relative to the permissible proximity to power circuits.

*Paper by W. H. Harrison and A. E. Silver.

Use of repeaters contributes to reducing the susceptiveness of the telephone plant. Although they naturally amplify the noise currents as well as the voice currents, the voice level is kept high throughout and gives an improvement in the ratio of voice currents to noise currents of the order of five to one. Carrier systems are much less influenced by noise induction from power circuits because they occupy a range of frequencies (5,000 to 30,000 cycles) in which power harmonics are ordinarily extremely small. The transposition essential to realize on carrier economy results in reduced susceptiveness to outside inductive influences. Soldering aerial wire sleeve connections, replacement of iron by copper wire, repeater coils acting as insulating transformers and interconnecting of aerial and underground cable sheaths all make a contribution to relief from inductive influences.

High-speed relaying helps

In the power systems the general trend toward larger concentration of power, with the accompanying tendency to increase the magnitude of system abnormals, complicates the co-ordination to an extent. The pronounced trend to higher transmission and primary distribution voltages appears to enhance the difficulties of co-ordinating communication and power lines, but there are certain alleviating factors. As transmission voltages increase line construction becomes more massive, clearances become greater and rights-of-way wider and costs rise. The highway often does not provide a clear or short route and the resort to private rights-of-way usually results in greater separation from communication routes. In the case of distribution lines better grades of construction accompanying increased voltages minimize both the abnormal conditions of operation and the risk of contact between circuits of the two systems.

More rapid clearing of faults in an effort to improve system stability tends to reduce the duration of transients. On the other hand, high-speed excitation may tend to increase the maximum fault current values and make co-ordination more difficult. Selective operation of protective relays is now being attained independently of time; the previous stage of relay development involved selective action, largely dependent upon an additive sequence of time intervals. The new development accomplishes large increases in the over-all speed of operation as well as enhancing the selectivity. These trends definitely aid co-ordination by reducing duration of transients, eliminating faulty relay operation and steadily reducing the radius of influence of system abnormals.

It is predominating practice to ground the neutrals of transmission systems at important transforming centers, sometimes through resistors or reactors, but usually solidly. Use of the solidly grounded neutrals tends to make co-ordination more difficult in view of the possibilities for increased flow of earth currents. There is, however, a trend toward increasing use of neutral impedance, and this, as well as the use of other types of current-limiting devices, constitutes an aid to co-ordination, since they reduce the magnitude of abnormal induction.

The major problem of the transmission art at the present time is the control of lightning in its effects on service. Present measures and indicated trends, especially for the higher voltages, directed toward the control of service interruptions caused by lightning include: Improved ap-

plication of overhead ground wires, improved grounding connections at the supporting structures, improved use of wood for lightning insulation, use (in shunt with line insulators) of fused gaps or other valve devices to spill the surge without dynamic current follow-up, and, finally, the application on grounded neutral system of single-phase switching. All these trends, with the exception of the last, are helpful from the co-ordination viewpoint because their effect is to avoid or reduce system faults, or at least to decrease the magnitude of earth fault currents and hence the accompanying voltages induced in nearby communication circuits.

Neutral grounding complicates the problem

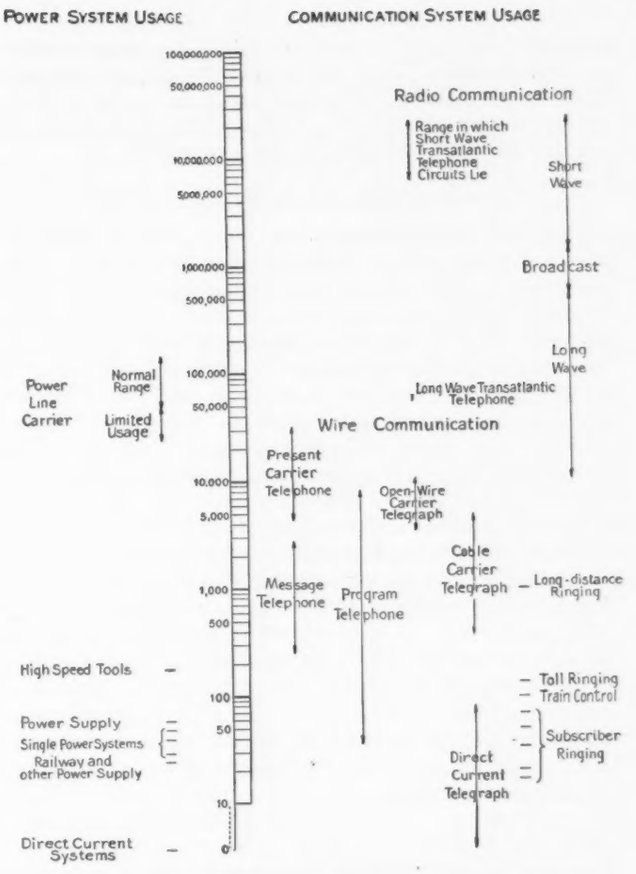
In most distribution systems two separate neutral networks have been employed for grounding purposes, one for the primary and one for the secondary system. However, in several localities these two separate neutrals have been combined into a common-neutral arrangement, providing in this way an increased multiplicity of ground connections to both primary and secondary neutral conductors. Further extension of this system is probable. It introduces features of interest from the co-ordination standpoint because of the increased opportunities for the flow of currents through the ground. Experience and investigations so far indicate that with adequate attention to co-ordination this arrangement is comparable to other types of distribution in its effect on neighboring communication circuits. The trend toward higher distribution voltages has been accompanied by Y-connection of the transformer primaries as a step in the transition from one voltage class to another. It sometimes involves a similar Y-connection of the secondary, usually in urban situations. Especial attention has been given to controlling the effects of this connection in situations of co-ordination; for the absorption of the triple-harmonic currents it is now common practice to use delta-connected tertiary windings.

The increasing use of rectifiers for conversion from alternating to direct current has an influence on inductive co-ordination and considerable study has been devoted to this matter, as a result of which methods for control of the distortion of the d.c. voltage wave caused by the rectifiers have been applied in several instances, and a solution of this part of the problem appears to be in hand. More study and experience, however, are needed as regards the specific conditions under which the wave shape distortion of the alternating-current supply would require consideration.

Unbalances create a major difficulty

The first method which comes to mind for the control of inductive effects is that of physical separation obtained by placing the power and telephone lines on separate routes. A separation between lines of a few hundred feet practically eliminates the noise-frequency problem, whereas the low-frequency problem may exist with much greater separations.* Another method of fundamental importance is the use of frequency separation. By this method circuits to be co-ordinated are arranged so as to be responsive to different frequencies or bands of frequencies employed for the other circuits. Co-ordination by frequency separation becomes inadequate

*Paper by H. L. Wills and O. B. Blackman.



Employment of frequency spectrum in power and communication

Most of inductive interference troubles reside in lower half of the spectrum scale.

when the power levels of the various classes of services differ greatly, as with power and telephone services. Thus, although incidental powers at harmonics of the power circuit fundamental frequency are negligible in comparison to the power at the fundamental frequency, they are large compared to the power employed in the telephone circuits and fall directly within the frequency range of the telephone circuits. The relative levels of harmonic frequency power in the power circuits and voice-frequency power in the telephone circuits are of major importance in inductive co-ordination. These considerations have had large influence in the power field in the control of wave shape of rotating machinery and transformers, and in the telephone field in fixing limitations of such factors as wire sizes, spacings of repeaters and instrument efficiencies.

Among the most important methods of co-ordinating power and communication circuits is the control of their respective balances to ground and to each other. A power circuit with absolutely balanced voltages and currents impressed and with the various conductors arranged in such a way that they would not establish external electric or magnetic fields would not have any effect on any type of neighboring communication line. Likewise, a telephone circuit in which there were no unbalances and in which the conductors were arranged in such a way that, in the presence of an electric or magnetic field, they

would not have any voltages induced between them, would not become noisy from any neighboring power circuits. Such an ideal state is impossible, but much has been accomplished by care in design of the lines and equipment and by the transportation of the conductors.

Wave shape not a serious factor

The two characteristics of a power system which are of primary importance in determining its inductive influence upon neighboring telephone systems are its wave shape and its balance. The wave shape is determined by characteristics of apparatus associated with the system. The balance is determined by the degree of symmetry of the supply voltages, load impedances and the series impedances and shunt admittances of the lines. Survey data on wave shapes indicate that the magnitudes of the harmonics present in voltage and current diminish with increasing frequency, with the exception that a pronounced dip occurs in the region from 800 to 1,500 cycles as a result of efforts of machine designers closely to control the harmonics in this important region.

A balanced power circuit is one in which the voltages between the various phase conductors and ground are equal in magnitude and sum up vectorially to zero and in which the phase currents are also equal in magnitude and sum up vectorially to zero. In a three-phase system where the currents or voltages are not equal, but do sum up to zero, the currents or voltages can be resolved into two balanced three-phase systems, one of positive phase sequence and one of negative phase sequence. In cases where the currents or voltages do not sum up to zero they contain a single-phase component, which is usually termed residual or zero-phase sequence component. Any three-phase system can therefore be resolved into its balanced and residual components and each treated separately.

The coupling for the residual components is usually much larger than for the balanced components and is therefore frequently of major importance in co-ordination problems. Experience has indicated that the outstanding factor in the unbalance of power systems is the existence of triple-harmonic voltage or currents, which may arise either in rotating machinery or in transformers which are connected in star with grounded neutral. Since the triple-harmonic voltages in the three phase-to-neutral legs are in phase, they act in a path consisting of the phase conductors and an external return, as, for instance, a metallic neutral or ground. A large measure of control may be exercised on the magnitudes of the triple-harmonic residual voltages and currents by the use of certain transformer connections and by not operating the transformers at high flux densities.

An effective method of control for cases in which star-star connections are required by phase relationships is the provision of a third set of windings (or tertiaries) in the transformers, the impedance of the tertiaries with respect to the other windings being sufficiently low to furnish an adequate path for the circulation of the triple-harmonic magnetizing current. An alternate method of control, which also provides like phasing on the two sides of the bank, is the use of zigzag connected transformers. In four-wire multi-grounded neutral distribution systems it has been found helpful in controlling the residual triple-harmonic currents from the single-phase load transformers to provide star-delta connected banks at various points in the network with neutrals connected to the system neutral.

The methods of control which have been successfully applied in cases in which star-connected generators, operating with grounded neutral, have been connected directly (or through star-star transformer banks) to transmission or distribution systems, include the following:

1. Isolating the generator neutral and supplying the system ground through a suitably designed transformer bank.

2. Grounding the neutral of only those generators designed to be free from triple harmonics in their phase-to-neutral voltage.

3. The use of selective devices, such as reactors or anti-resonant circuits (commonly called wave traps), in the generator neutral for suppressing the disturbing triple-harmonic components.

In multi-grounded-neutral four-wire systems differences in the single-phase loads connected between the individual phases and the neutral may be important sources of residual current. A considerable measure of control may be exercised by restricting the size of single-phase areas and by balancing the load on the different phases. The capacity unbalancing effect of single-phase branches on the three-phase system may be minimized by equalizing the lengths of the branches connected to the several phases. The residual voltage on the single-phase branch can, where necessary, be eliminated by the use of isolating transformers or by converting to a three-phase branch. Transpositions are effective in controlling the capacity unbalance arising from dissymetry in the arrangement of the wires of the circuit with respect to each other and to ground.

Consideration has been given to the possibility of increases in power levels on local exchange circuits and on toll circuits. In development work on telephone transmitters telephone engineers are proceeding on the basis that more is to be gained by improving the frequency response of the transmitter than can be gained by mere increase of power; this will have the effect of raising power levels at frequencies where they have been relatively low.

Earth conductivity an uncertain factor

Three-phase power circuits, when operating normally, are so nearly balanced with respect to earth at their fundamental frequency and telephone circuits of the ordinary type are relatively so insensitive at frequencies of 25 or 60 cycles that induction at these low frequencies under normal power line conditions is rarely a practical problem. But when abnormal conditions, particularly faults to ground, occur on power lines large unbalanced voltages and currents at fundamental frequency exist temporarily; at such times there may be induced in neighboring telephone circuits voltages which are hundreds of times as great as under normal operating conditions.* In most low-frequency induction problems the residual current in the power system is far more important than the residual voltage. Neutral impedance may be an important factor in determining the magnitude of this residual current. On a steel tower line an insulator

*Paper by R. N. Conwell and H. S. Warren.

breakdown results in a relatively short arcing path to grounded metal, whereas in wood-pole construction the pole itself introduces considerable impedance unless nullified by guys or other metal. A ground wire tends to increase the total residual current, but, on the other hand, it affords an inductive controlling function by way of its shielding influence.

The effect of earth conductivity on coupling is accentuated as the lines are more widely separated. At roadway separation large differences in earth conductivity affect the coupling only moderately, but at separations of ½ mile to 1 mile coupling values may differ by twenty to one or more due to the range in value of earth conductivity.

High-speed breakers and relays are expensive and it is difficult to justify them solely as a remedial measure for induction, particularly as the speeds of operation now available for relays and breakers on power systems have not reached values which make them a complete solution of the co-ordination problem. However, with the increasing size and the interconnection of power systems, high-speed relays and circuit breakers are playing an increasingly important part in promoting power system stability. If such devices come into general use for all classes of service it is expected that they would materially improve the whole inductive situation.

Some of the developments which are being studied in the telephone field are line and relay protectors, acoustic shock reducers and saturating receivers, neutralizing transformers and ground conductors for shielding.

▼ ▼ ▼

Steam Station Auxiliaries Trend Toward Electric Drives

Electrically driven auxiliaries for steam generating stations are increasing in number and newer applications are establishing their reliability, according to a report of the electrical apparatus committee of N.E.L.A., which summarizes the types of auxiliary drives for 37 new stations, or additions to old stations in which a definite change in plans has been undertaken.

A large increase is shown in the number of electrically driven condensate pumps, and reports again indicate that electrically driven stokers are reliable. The trends, reserve service, outage allowance and speed control for the auxiliaries are summarized in the accompanying table.

Summary of Trends, Reserve Service, Outage Time Allowed and Speed Regulation of Auxiliaries

Unit	Outage	Trend	Reserve	Speed
Boiler feed pumps	Not over 1 minute	Decrease in steam-driven reserve pumps Decease in installations with full capacity reserve	Some in all installations	Adjustable, speed range of from 10 to 20 per cent
Circulating pumps	Continuous operation	Increase in full spare capacity	Increase in use of two pumps per condenser	Use of constant speed motors on increase
Condensate pumps	1 minute or less	Increase in use of electric pumps	90 per cent with full capacity reserve	Constant speed used in 75 per cent of installations
Air pumps	3 minutes or longer	Increase in use of steam jet air ejectors and decrease in motor-driven pumps		Constant speed motors
Service pumps	3 minutes or longer		Full duplication of pumps with motor-driven spares	Constant speed motors
Draft fans	1 minute or less	No changes in drive	80 per cent have no reserve	
Stokers	3 minutes or more	Experience indicates that electric drive is thoroughly reliable	None	Adjustable except one. Over 80 per cent have speed range of 50 per cent or more
Clinker grinders		Tending toward operation from same drive as stokers	None	Adjustable, with 20 or more steps of speed control
Air compressors	Indefinite	No change	Some duplication usually provided	Constant speed motors
Crushers and conveyors		Away from duplication	24 to 48 hours supply of crushed coal in bunkers	Constant
Pulverized fuel feeders	80 per cent allow 15 seconds or less	Increase in use of pulverized fuel	75 per cent without any duplication	Adjustable with speed range of 50 per cent or more
Pulverized fuel blowers	89 per cent allow 15 seconds or less		75 per cent without any duplication	Constant speed used by two-thirds of companies
Pulverizers	3 minutes or longer for central pulverizers; 5 seconds for unit pulverizers	More companies use central systems than unit systems		Constant speed motors

Bulgaria Develops Power Despite Financial Position

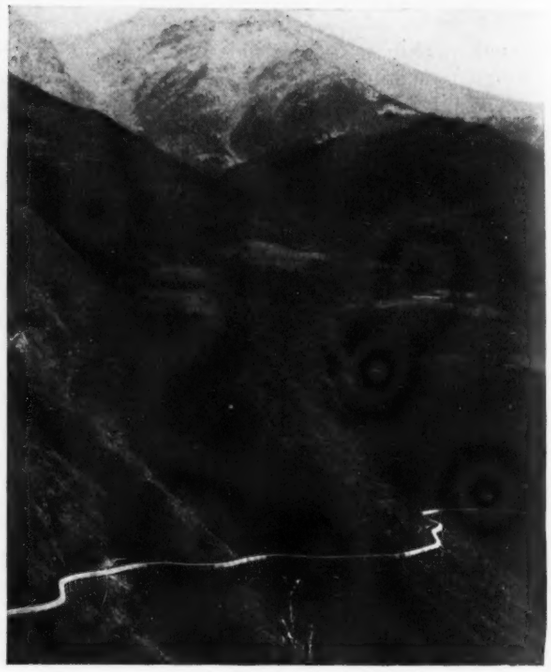
By NIKOLAY von KOTSCHUBEY
Zurich, Switzerland

In spite of the present somewhat difficult financial position of Bulgaria, the government and the public utilities of that country have made a great effort to utilize the available national water-power and fuel resources. The total rating of the Bulgarian power plants has increased from 14,000 kva. in 1918 to about 90,000 kva. Up to the present, however, only 50,000 hp. of the 1,000,000 hp. of water power available has been put to use, which leaves 95 per cent still to be developed. To further the progress of the development of power generation attempts are being made to attract foreign capital.

Of the total output in 1928, 41.7 per cent was produced by water power and 58.3 per cent by fuel power. Of the fuel-power plants thirteen used coal and 103 used oil, the large number of oil engines showing that bulk power supply practically does not exist. Among the central stations which have been recently installed, five are water-power plants, with a total capacity of 18,820 kva., and two are steam-power plants, with 15,300 kva. capacity. The water-power plants deliver, as a rule, their full capacity during 2,500 hours in a year's time; the steam-power plants have only 1,400 hours full use per year.

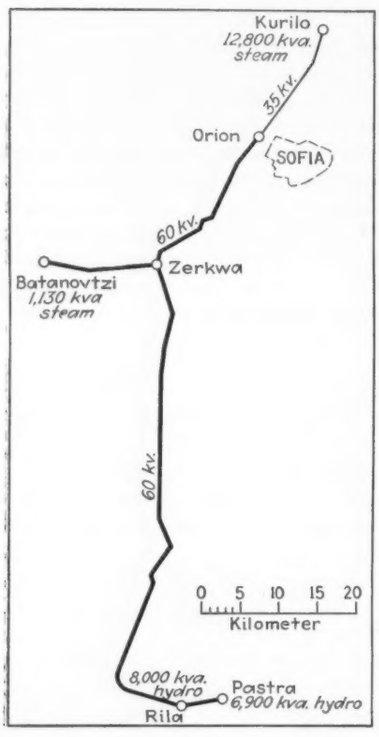
Of the 45 most important plants, one belongs to the Bulgarian states, eight to different municipals, seven to public utilities with important government interests, seventeen to public utilities without government interests and twelve to small private utilities with purely local interests. The total amount of energy generated in 1928 in these power plants was 65,286,412 kw.-hr.

The main power supply centers are Sofia, Warna, Russe, Sliwen, Plewna, Burgas and Kasanlik. Sofia alone consumes yearly about 30,000,000 kw.-hr.



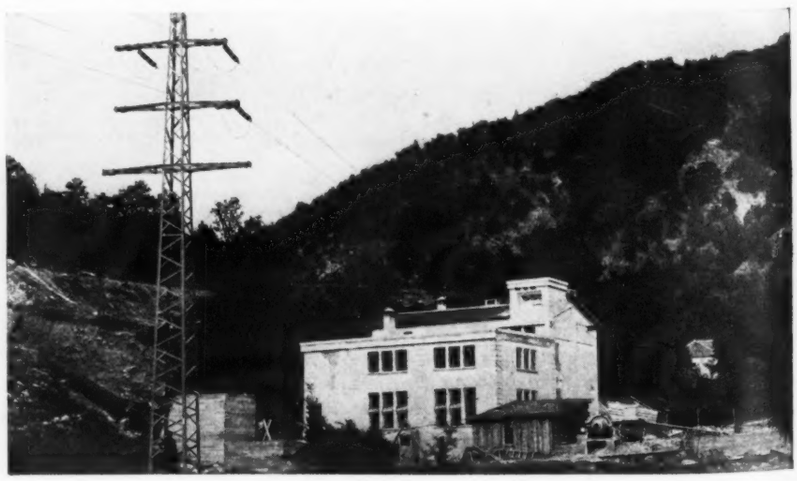
Concrete tunnel supplies water power for generating station

This concrete tunnel leads to the Pastra plant of the Granitoid Company, Ltd. It has a total length of 6.2 km. with a cross-section of 2x2.2 meters. The maximum allowable water flow through this tunnel is 10 cu.m. per second.



Granitoid Company, Ltd., supplies power to Sofia suburbs and southwestern Bulgaria

Electrical energy is supplied Sofia in bulk by the Société Electrique de Sofia et Bulgarie (French and Belgian interests), from the 12,800-kva. steam power plant at Kurilo and the water power plant of 3,180 kva. at Pantschewo. Energy generated in these power plants is added to that supplied by the 1,720-kva. Boiana and 860-kva. Simeonowo power plants, which belong to the Sofia Municipal Council.



Rila water-power plant of the Granitoid Company, Ltd.

When completed this plant will have an ultimate capacity of 13,770 hp. in three Francis turbine units. The plant has a head of 155.43 m. with a maximum water flow of 8 cu.m. per second.

Metal-Clad Switchgear

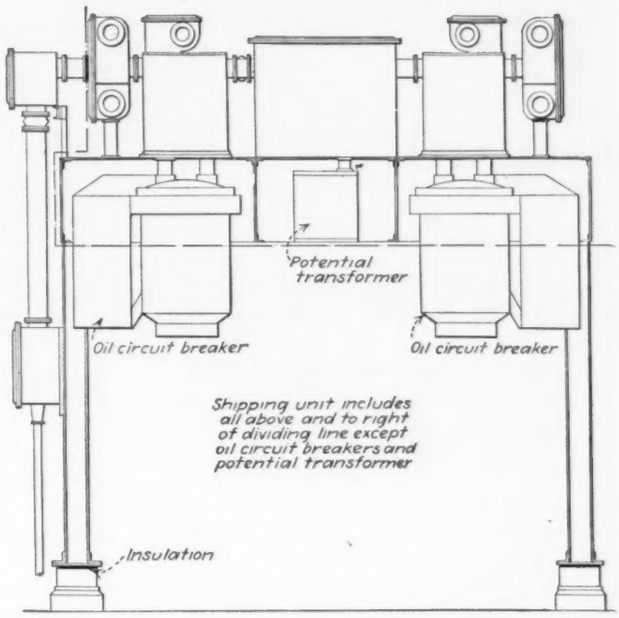
Designed for Large Unit Shipments

By ALLEN M. ROSSMAN
Sargent & Lundy, Inc., Chicago, Ill.

EXPERIENCE in the erection of outdoor oil-filled metal-clad switchgear and developments in design arising from that experience are beginning to have their effects on costs. It may be said even now that the total over-all cost of some recent 33,000-volt structures of this type, erected and ready for service, compares favorably with the cost of conventional open-type structures designed for the same service and erected at the same time in the same district of the country. This result has come about principally from modifications of design that permit manufacturers to make larger factory assemblies of parts.

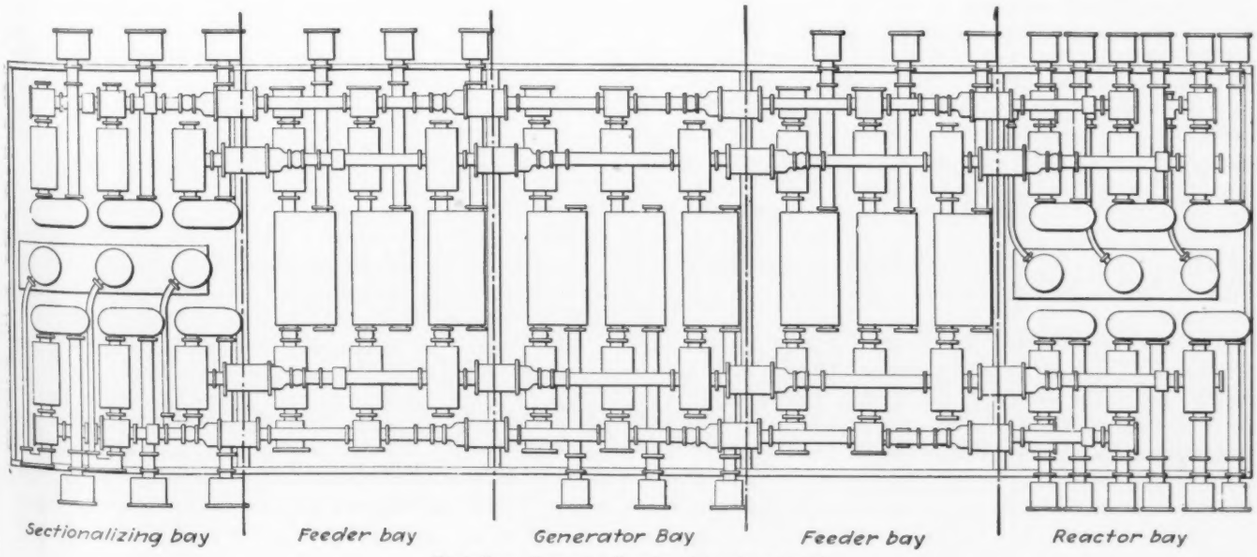
The first design of heavy-duty metal-clad switchgear was shipped in a large number of pieces which were assembled in the field. The second design was factory-assembled in groups of related parts as large as was permitted by railroad clearances. These groups were joined together in the field to form the complete structure. Both schemes of assembly meant shipping without oil and a certain amount of drying out in the field. In the latest design the arrangement of parts has been so modified as to bring the length of a bay within the clearance width dimensions established by the railroads. Each bay now may be completely assembled at the factory, filled with oil, tested and shipped as a unit. Oil circuit breakers and potential transformers—pieces of equipment which are normally detachable—are, of course, shipped detached from the structures.

The nineteen bays of switchgear manufactured by the Westinghouse Electric & Manufacturing Company for the second section of the State Line generating station, as reported in the ELECTRICAL WORLD of July 12, 1930, is of this design.

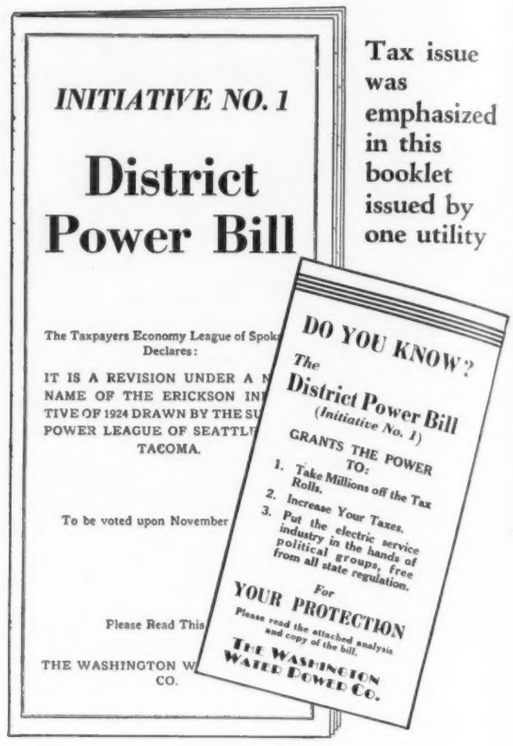

Potential transformer
Oil circuit breaker
Oil circuit breaker
Shipping unit includes all above and to right of dividing line except oil circuit breakers and potential transformer
Insulation

Factory assembly of complete bays lowers cost of metal-clad switchgear

This typical group of bays designed for the second unit of State Line, now in construction, shows several units of metal-clad switchgear, each unit of which is assembled at the factory and shipped, oil-filled and tested, to the field. The elevation of a typical generator or feeder bay, rated at 3,000 amp. at 25,000 volts and with breaker capacity of 2,500,000 kva., shows one of the factory-assembled units.



Washington Bill Authorizes Vote on Power Districts


INITIATIVE NO. 1
District Power Bill
The Taxpayers Economy League of Spok
Declares:
IT IS A REVISION UNDER A N
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POWER LEAGUE OF SEATTL
TACOMA.
To be voted upon November
Please Read This
THE WASHINGTON W
CO.
DO YOU KNOW?
The
District Power Bill
(Initiative No. 1)
GRANTS THE POWER TO:
1. Take Millions off the Tax Rolls.
2. Increase Your Taxes.
3. Put the electric service industry in the hands of political groups, free from all state regulation.
For
YOUR PROTECTION
Please read the attached analysis and copy of the bill.
THE WASHINGTON WATER POWER CO.

Tax issue was emphasized in this booklet issued by one utility

SPONSORED by the Washington State Grange, a measure known as the district power bill passed in Washington on November 4, 1930, by the narrow vote of 152,487 for and 130,901 against the proposal. Passage of this bill gives country districts the same rights and powers—or greater ones—to go into the utility business as are now possessed by the incorporated cities and towns of the state.

The bill sets up the necessary machinery for the creating of so-called utility districts with power to engage in the development, distribution and sale of electrical energy and with power to take over all of the plants and property of existing private companies in the state. Districts may be formed by popular vote in the territory included and, when formed, would be controlled by three commissioners with power to raise money in any one of the following five different methods: by levying a direct tax; by issuing general bonds without a vote of the people; by issuing public utility bonds without a vote; by creating local improvement districts and assessing the abutting property; by incurring general indebtedness and the issuance of warrants and bonds in payment thereof. The bill is too long to reprint herewith, but obviously it grants broad and almost unlimited powers and could easily become a very dangerous political tool.

Why the bill passed

To a representative of ELECTRICAL WORLD who interviewed a number of people in Washington in connection with the passage of this bill there appear to be four primary reasons why it carried: (1) Effect of the unfair and one-sided "power trust" publicity resulting from the Federal Trade Commission investigation; (2) general unrest resulting from business depression and a desire for any kind of a change; (3) a general feeling that the country districts should have the same right to go into the power business that the cities now enjoy, and (4) a desire for a club over the heads of the power companies to force them to liberalize their line extension policies and reduce rates.

Senator Dill of Washington and members of the State Grange were the most active supporters of the bill. All based their appeal largely upon the argument that country districts should have the same rights as cities and that no formation of utility districts was contemplated, the measure simply to serve as a curb on the private companies. Both arguments apparently seemed logical to the voters; the second, however, is altogether unique. One does not recall any former campaign anywhere for a measure that was advocated upon the theory that no use of it would ever be made. However, a great many voters were convinced that a merely permissive measure, authorizing district competition with utility companies, could be used as a bogey man if, when, as, and in case utility companies did not behave themselves. They worked on the theory that this threat would be an effective substitute or accompaniment of state regulation, namely, that if public utility companies failed to render adequate electric service at reasonable cost, and if the state regulating commission proved incompetent to compel such service and rates, then the utility companies as a lesser evil would do what any well-managed utility company would have done in the beginning.

Dissatisfaction with the rural line extension policy of Washington utilities and the rates charged the farmers are the reasons for passage of the bill, according to Albert S. Goss, master of the Washington State Grange, in a statement to a representative of ELECTRICAL WORLD. As a matter of fact, Washington ranks high among other states in the Union in respect to extensiveness of rural

service. One company alone has spent $5,500,000 in the past eight years in building 5,000 miles of rural lines to serve 40,000 customers. All of this has taken place under extension rules worked out with the greatest of deliberation by the utilities and the commission, but, like many such rules, they are difficult to explain to the farmer. One particular sore spot with the farmer, according to Mr. Goss, is the fact that in many cases he is called upon to pay the cost of a line and yet he does not own it. Actually, in the case of the above company, $2.50, plus cost of transformer, is put up to get $1 in revenue at the regular rates for service in that general territory; or, in other words, the same rates for service as are enjoyed by the towns of the district. Where extensions beyond the 2½ to 1 plus transformer ratio are exceeded the farmer is asked to put up enough prepaid revenue to cover fixed charges on the unprofitable investment for the period over which it is estimated that the line will not be self-supporting. However, the fact remains that there is some dissatisfaction and the utilities of Washington may simplify and possibly liberalize extension rules.

In analyzing the vote it seems paradoxical to find that both Seattle and Tacoma, strongholds of municipal ownership, voted small majorities against the bill. Only two plausible explanations can be found for this seemingly strange turn of affairs. Either the people of Seattle and Tacoma are not so well satisfied with their municipal light and power ventures or else they are afraid of being drawn into utility districts and losing their hydro developments, which are all outside their corporate limits.

Outcome not likely to be unfavorable

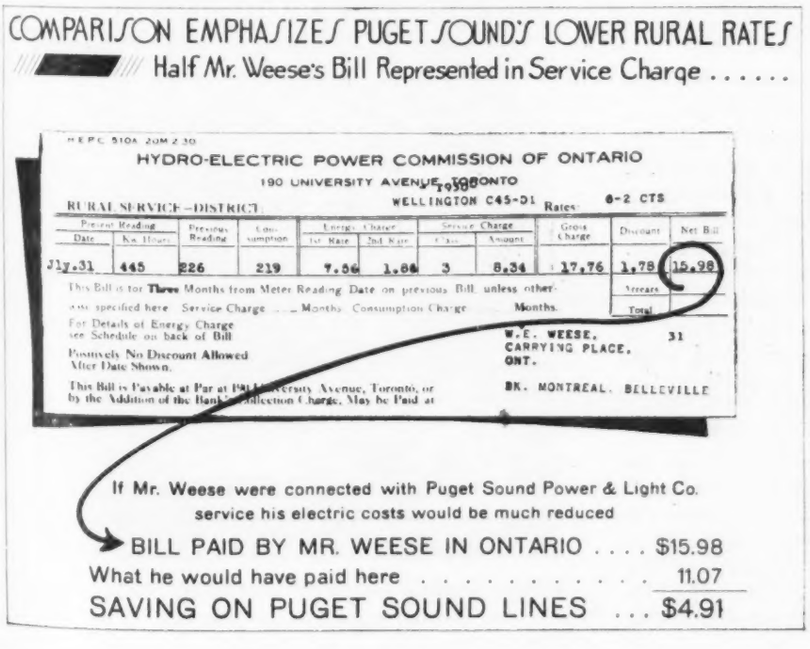
Utility leaders in Washington do not view the situation with alarm. A. W. Leonard, president Puget Sound Power & Light Company; Guy W. Talbot, president Pacific Power & Light Company, and F. T. Post, president Washington Water Power Company, all stated that they plan to go right ahead with their program of power development, extension of service, load building and reduction of rates as usage and further economies will permit.

It does not seem likely that the public will make any great use of the formidable weapon with which it has armed itself. Certainly the public has little to hope for from any attempted use of the new measure. Few places have greater availability of electrical energy, better service or lower rates. What more could be asked and, besides, there already are millions and millions of dollars of tax-free property, by reason of the Seattle and Tacoma municipal systems, and if any more property is to be removed from the tax rolls a revolutionary upheaval in the whole tax structure in the State of Washington will result.

The people of the State of Washington, outside the cities of Seattle and Tacoma, long have been disgruntled over the fact that they were carrying a disproportionate share of the tax burden and there are indications that passage of the district power bill is only the forerunner to a series of events which will lead up to taxation of municipal utilities. What could be more encouraging to the private utilities that have so long striven to have municipal utilities put on the same basis of taxation and accounting as the private companies?

Mr. Goss stated that he realized promoters might take advantage of the power bill to try and foist unsound schemes upon the public, but that the Grange would discourage any and all unsound developments. Agitation for the formation of two power districts has already been reported, but this was found to be untrue. In any event, the bill provides that a vote on the formation of a utility district can be taken only at general elections, which are held every two years, so that it will be at least two years before any districts could be formed. Each proposal to form a power district will constitute a local issue upon which threatened taxpayers will concentrate attack. The fact that California has had a somewhat similar law since 1921 and that under it only two utility districts for water supply only have been formed indicates that the public is much more reluctant when it comes to voting bonds for a specific purpose than it is to pass on a general proposition.

In opposing the district power bill the utilities of Washington used newspaper advertising extensively, supplemented by booklets, pamphlets, the radio and personal canvassing. One very effective piece of publicity was a booklet distributed by the Puget Sound Power &


COMPARISON EMPHASIZES PUGET SOUND'S LOWER RURAL RATES
Half Mr. Weese's Bill Represented in Service Charge . . . . . .
HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO
190 UNIVERSITY AVENUE, TORONTO
WELLINGTON C45-01
RURAL SERVICE—DISTRICT
Rates 6-2 CTS
Present Reading
Date
Kw. Hours
Previous Reading
Consumption
Energy Charge
1st Rate
2nd Rate
Service Charge
Class
Amount
Gross Charge
Discount
Net Bill
July 31
445
226
219
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1.78
15.98
This Bill is for Three Months from Meter Reading Date on previous Bill, unless otherwise specified here. Service Charge ... Months. Consumption Charge ... Months.
Arrears
Total
For Details of Energy Charge see Schedule on back of Bill
Positively No Discount Allowed After Date Shown.
W. E. WEESE, CARRYING PLACE, ONT.
31
This Bill is Payable at Par at ... University Avenue, Toronto, or by the Addition of the Bank's Collection Charge, May be Paid at
BK. MONTREAL, BELLEVILLE
If Mr. Weese were connected with Puget Sound Power & Light Co. service his electric costs would be much reduced
BILL PAID BY MR. WEESE IN ONTARIO $15.98
What he would have paid here 11.07
SAVING ON PUGET SOUND LINES . . . $4.91

Sheet from booklet comparing rural rates in Washington with those in Ontario

This booklet was given wide circulation in opposing district power bill.

Light Company. A number of photographic copies of bills of the Hydro-Electric Power Commission of Ontario were reproduced and the saving to a Washington consumer using a like amount of energy was shown.

Although the campaign of education was of a thorough and painstaking character, which will count heavily in the future, the utilities of Washington learned the same thing that the utilities of Oregon did in fighting a losing battle against a similar measure.

A campaign of education, while it convinces the more intelligent community element during the campaign, requires much more time to educate the masses. The masses must be educated between campaigns. In the final analysis it did little good to convince the banker, the lawyer, the doctor and the business man, who comprise only about 15 per cent of the voters. It was the other 85 per cent that could not be reached during a short campaign that was the determining factor. How to appeal to the self-interest of this 85 per cent is the great problem before the industry.

Utility leaders of Washington harbor no grudge against the citizens of Washington. They will intensify their programs of the past and so constructively build good will through good service and lower rates that the public will have no desire to exercise the provisions of the bill.

It is of interest to note that few cities and towns have, during the past fifteen or twenty years, taken advantage of similar provisions in laws affecting municipal corporations to enter the light and power business.

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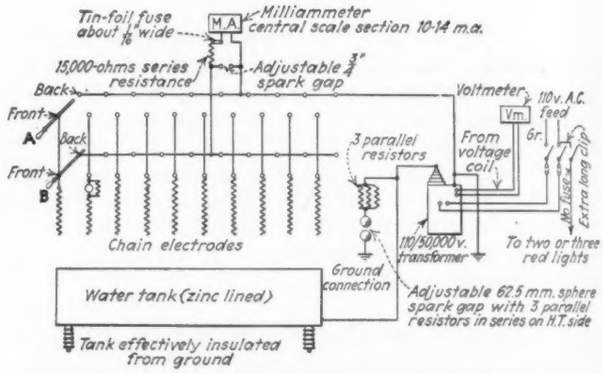
Testing Gloves Speedily in New England

Glove testing on the system of the New England Power Association is now centralized at Providence, R. I., and Worcester, Mass., for the subsidiary properties under this management, the standard arrangement of apparatus being shown in the accompanying illustrations. The method of test is based on the specifications of the American Society for Testing Materials. The wiring arrangement employed enables the tester to measure leakage currents through any individual glove in the row suspended in the tank without interrupting the circuit and by the simple act of inserting and withdrawing high-tension plugs from jacks mounted on the test panels. A 50-kv. transformer supplies the required test potential, but the maximum test voltage is 14 kv.

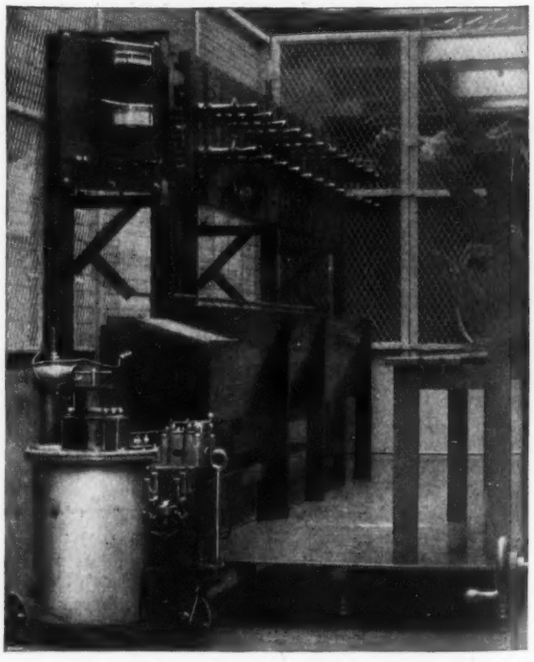
Two rows of receptacles of the series arc type are provided, each row having front and back connections which are completed by inserted plugs. The rear receptacles of the top row are all grounded and the back receptacles of the lower row are all connected. Each front receptacle of the upper row is in contact with the corresponding front receptacle of the bottom row. The chain electrodes entering the gloves hang from the receptacles in the bottom row.

In ordinary testing the top plugs are inserted and the bottom plugs are pulled out. The chain electrode is thus connected to the grounded side of the system. To measure the leakage current of any particular glove the bottom plug of the glove under test is first inserted, after which the top plug is pulled out, breaking the connection to the rear receptacle. This throws the milliammeter into the circuit of the glove, leaving all other gloves under test as before. After taking the milliammeter reading the top plug is again inserted, and following this the lower plug is pulled, restoring the glove to the former test conditions. Needle remains on scale unless sphere gap voltage exceeds 500.

Water inlet and drain pipe fittings are insulated from the tank, with a minimum clearance of 6 in. between the water inlet and the tank and 6 in. from the drain funnel to the drain pipe.



Centralized test apparatus at Providence



Glove-testing outfit is screened, locked and insulated from ground

Off-peak low-value electrical energy heats this new office building

Installs Electric Heat to Test Economy

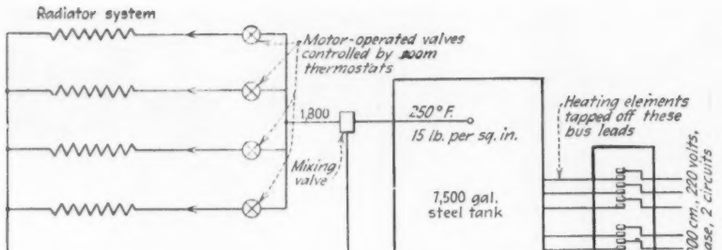
"GRANTED that we as executives of a power company have faith in the growth of electric heating of buildings as time goes on, can we afford to risk our stockholders' money right now in equipping our new building at Greenfield with no other method of keeping it warm in the face of an oncoming New England winter? Can we afford to do it when we consider the price of heating by fuel? Isn't the cost of electrical energy, even on a power system, too high to justify such a course? Yet, where are we going to obtain intimate experience with electric heating on such a scale if we do not undertake it ourselves?"

These were but a few of the questions discussed by the executives and engineers of the Western Massachusetts Companies across the conference table before a decision was reached to build the new home of this organization at Greenfield without a chimney, turning to off-peak hydro energy and hot water storage as the solution of this timely problem. Complete answers to questions bearing upon the economics of the installation must await publication at the end of the present winter, but President Harry E. Duren of the Greenfield Electric Light & Power Company states that preliminary operation indicates that the operating cost will not exceed that of fuel oil by over 10 per cent. The quality of service enjoyed by the occupants of the building and by visitors during the weeks since its opening about the middle of November appears to meet every need.

The typical 24-hour load curve of the Greenfield company, the local affiliate of the Western group, exhibits forenoon and afternoon peaks dominating the chart between 8 a.m. and noon and from 1 to 5 p.m. At all other hours "dump" hydro energy from the system can be utilized advantageously for such charging of the office building water tank as may be demanded by temperature conditions in the various rooms reflected in calls upon the tank for circulation through the piping and radiator system. The "Hallmark" heating system of the Hall Electric Heating Company, Inc., Philadelphia, was selected for the job, and it is interesting to note that on a number of recent milder days the heat storage capacity of the tank and piping system has been sufficient to warm the establishment satisfactorily without feeding a single kilowatt-hour into the tank.

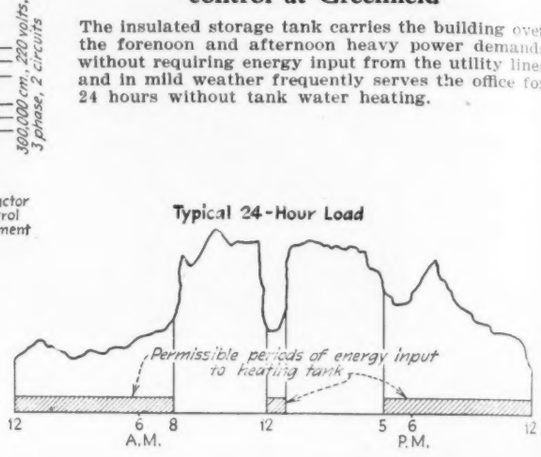
The new building is a handsome one-story and basement structure occupying a ground space of 110 ft. x 70 ft. in the center of the business district. A demonstration room and substation are located in the basement, and the heated volume of the building is 102,400 cu.ft. The tank has a capacity of 7,500 gal. of water and 210 kw. in immersion type units with balanced load on three-phase, 220-volt, 60-cycle supply are in use, making in round numbers 1 kw. of heating capacity per 500 cu.ft. of volume.

With the exception of the demonstration room, the entire building is heated by direct cast-iron radiation. An extended surface blast type heater with centrifugal fan for circulation of air is utilized in this room, the heating coils being supplied with hot water from the tank. Each radiator is equipped with a Dole thermostatic butterfly valve which admits slugs of 180-deg. water according to temperature variations within the radiator. The admission of water to the four main piping sections into which the system is divided is governed by motor-operated con-



Scheme of heating, system layout and control at Greenfield

The insulated storage tank carries the building over the forenoon and afternoon heavy power demands without requiring energy input from the utility lines and in mild weather frequently serves the office for 24 hours without tank water heating.



Permissible periods of energy input to heating tanks

Only the hours of heavy day load are reserved for disconnecting power supply to the water storage tank serving the Greenfield company's building.

trol valves responsive to thermostats at strategic points. To insure adequate circulation of water two centrifugal pumps, each direct driven by a 1/6-hp., single-phase, 110-volt motor are provided, either being sufficient for the plant. Water is delivered from the top of the tank at 250 deg. F. and about 15 lb. pressure, and after passing through a mixing valve enters the piping at 180 deg. The charging of the tank from the electric circuit is controlled automatically by variations in the tank pressure.

Normal temperature maintained is 70 deg. F. for the entire 24-hour run at present, although the system was designed for keeping this temperature between 8 a.m. and 9 p.m. The minimum outside temperature base is 10 deg. below zero F. The building is of concrete and steel construction, with an exterior finish of face brick. The walls are furred on the inside, lathed and plastered. The first floor ceiling is covered with 4 in. of rock wool insulation and the calculated heat loss of the building under maximum conditions is 436,000 B.t.u. per hour. The maximum demand of the tank heaters is their full rating, and spare elements totaling 10 kw. are installed to permit quick substitution in case of a failure.

Outlook for efficient performance

The control panel equipment included provision for routine measurements of energy consumption, water supply, temperatures and other items of value to the company in studying the performance of the system seasonally and daily. The estimated increase in operating cost above fuel oil was small enough to bring about the use of electricity, with its well-known advantages in cleanliness, flexibility of control, hygenic conditions and potential further use in this field. In the case of the Greenfield company, its Gardner Falls hydro station on the Deerfield River receives daily flowage from other plants above which does not cease at 5 p.m., when the major industrial loads go off in this part of New England. The excess water cannot be stored in the river, as there is no additional storage capacity in the river valley. Hence the advantage of utilizing dump power for heating service. The cost of such energy is low enough to make it attractive for the purpose in comparison with primary power.

For the month of December, 1930, the total input to the heating installation at the Greenfield office was 33,100 kw.-hr., the maximum load being 225 kw. The coldest day had a maximum temperature of 22 deg. F. and a minimum of 15 deg. F., with a strong northwest wind. The mean temperature for the month at Amherst, Mass., 15 miles distant from Greenfield, was 28 deg. F. The minimum temperature of the month at Greenfield was about 4 deg. F. below zero. At the conclusion of the winter it is anticipated that the power company will release complete data on the performance of this interesting installation throughout the weather fluctuations of the season.

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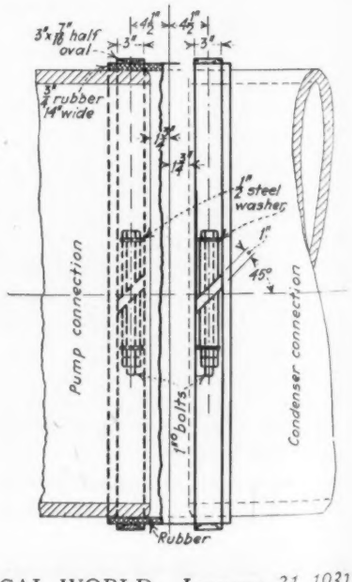
Rubber Joints Used Between Condenser and Pump

Rubber joints are used between the circulating pumps and condensers in the Belle Isle station of the Oklahoma Gas & Electric Company. This joint is simply a rubber-fabric dredging sleeve held to the pipe ends by half-oval iron straps. It is unnecessary to flange the pipe ends to receive it.



Dual-Purpose Lighting for Healthful Offices

Sitting at his desk, the business man may work early or late, get his ultraviolet without time out on the golf course, and avoid the tired feeling to which he is traditionally addicted. That's one sign of the times.

In the office of the president of the Cleveland Electrical League—also, as illustrated, in that of Mr. Luckiesh, director Lighting Research Laboratory of the General Electric Company in Cleveland—hangs a special dual-purpose ceiling fixture that gives light for both health maintenance and vision.

These pioneer dual-purpose luminaires supply a high

Artificial sunlight is available here day or night

intensity of illumination on the desk top—approximately 80 foot-candles—without creating a feeling of "too much light." Relatively few offices have 10 foot-candles of artificial light intensity and offices with 30 foot-candles are rare. The lighting is pleasing and comfortable and the ultraviolet radiation has the same health-maintaining characteristics as outdoor summer sunshine.

This particular lighting fixture has an upward or indirect lighting component which is supplied by eight 100-watt "Mazda" lamps equally spaced in the upper portion connected to two circuits. This alone supplies a general illumination of 10 foot-candles. The downward component of light and the ultraviolet radiation are produced from one sunlight "Mazda" lamp (S-1) located in the center of an oxidized aluminum reflector equipped with baffle-rings which control the light distribution and ultraviolet radiation. Metal work resembling the spokes of a wheel support three concentric cylindrical oxidized aluminum baffle-rings that shield the eyes from direct view of the S-1 lamp.

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READERS' FORUM

Currents Required to Remove Conductor Sleet

To the Editor of the ELECTRICAL WORLD:

With much interest I read the article about "Currents Required to Remove Conductor Sleet," by J. E. Clem, in the December 6, 1930, issue of the ELECTRICAL WORLD, on page 1053. I think that some errors slipped in. In the chart for amperes required to prevent ice formation you read the formula

$$I^2 = \frac{\theta R\sqrt{dv}}{8.18}$$

Should not that formula read $I^2 = \dfrac{\theta\sqrt{dv}}{R \times 8.18}\ 10^4$?

In formula (3) is read $T = 1.151\, P\rho w_e \log \dfrac{d_i}{d}$, P must be d. In chart for amperes required to melt off glaze, you read:

$I = 46.25\sqrt{w\dfrac{d}{R}}$. This ought to be: $I = 462.5\sqrt{w\dfrac{d}{R}}$.

On page 1055 in the end of the first column there is given an example of calculation. The resistance of the conductor is not mentioned. When you work backward (see the end of the second column) with equation (2) you find $R = 0.44$ ohm/mile. Afterward a basis is mentioned of 0.8 ohm/mile. Why is this?

The Hague, Holland. **P. LA FONTAINE.**

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The three corrections suggested by your correspondent apply. However, it should be noted that these are mistakes in preparing the tracings, made after the charts were drawn up, and that the accuracy and usefulness of the charts are not impaired by these mistakes.

Mr. La Fontaine raises the question in regard to the value $R = 0.44$ ohm per mile, and another value of impedance of 0.8 ohm per mile appearing in the third line near the top of the first column of page 1056. I am not quite clear as to just what Mr. La Fontaine's difficulty is, but it seems that he is associating two quantities that refer to different things. The value $R = 0.44$ ohm per mile is the value of resistance of a No. 4/0 aluminum cable and was used in the chart on page 1055. The value of 0.8 ohm per mile is the approximate reactance of a line and was used only in estimating how much current might be forced through the line.

General Electric Company, Schenectady, N. Y. **J. E. CLEM.**

BOOK REVIEWS

Amber to Amperes

By Ernest Greenwood. Harper & Brothers, New York. 321 pages, illustrated. Price, $4.

Would you know what mention history makes of electrical manifestations beginning with the magnetic emblem on Hoang-Ti's chariot in 2637 B.C.? Solomon's temple had lightning rods, compasses gave naval aid in the siege of Troy, Thales mused about the properties of charged amber—dark ages with never a record—then Dr. Gilbert writes De Magnete in Elizabeth's reign, Galvani energized frogs' legs, Franklin's kite lured lightning, Faraday and Edison were impelled by pure accident to master the mysteries. These and scores more of the obscure antecedents of today's commonplace electrical concepts establish Greenwood's volume as a welcome influence to poetize prosaic electricity. He takes you "behind the veil" and reveals the evolution of electrical philosophy from the days of mysticism and alchemy through the tangible researches of the pioneers to the concrete realizations of the electrified age. The book is a mine of information, from which the engineer can enliven his thinking, his speaking and his literary efforts.

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Analysis of Laws Governing Mutual Savings Bank Investments

By the National Association of Mutual Savings Banks, New York.

This is a comprehensive survey of the investment legislation in eleven of the states in which mutual savings banks are located. It covers, first, the type of securities that may be purchased by such institutions, showing the variation in existing legislation in the various states concerned and drawing distinction between the conditions governing purchase in the case of various classes of bonds, such as public utility, municipal and government bonds.

The volume contains 134 pages, is well indexed, and should prove valuable to any one interested in the investment policies of mutual savings banks, as well as the state legislation governing such investments.

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Electrothermie

By M. Pirani. Julius Springer, Berlin, 1930. 291 pages.

This book by Professor Pirani contains a series of lectures delivered by specialists on electrothermy, but does not cover the subject completely. For instance, there are no chapters on heat-treating furnaces, electric welding or electrolysis from the molten state. But a large number of experiences are reported which make the book extremely valuable as they can hardly be found anywhere else in the present-day literature.

The lectures deal with (1) the electrothermics of iron, describing in general the generation of electricity and the different advantages and systems of electric furnaces; (2) electric melting furnaces for non-ferrous metals; (3) manufacture of silicon carbide: carborundum and alumina cement; (4) artificial or electrographite; (5) calcium carbide factories; (6) physical and chemical properties of fused quartz; (7) electrothermics of gases, especially the formation of NO in atmospheric air; (8) electrothermal research problems, and (9) measuring instrument and processes used in electrothermy.

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Elementary Electricity

By Edgar P. Slack. McGraw-Hill Book Company, New York. 279 pages, illustrated. Price, $2.

This book is intended for use in vocational and industrial schools, by students who have not studied electricity before and whose mathematical training may not have gone beyond arithmetic. The treatment is based on the modern electron theory, and the student who continues his work in college should find few changes needed in his fundamental ideas. The subject matter and the presentation are based on some twenty years of varied teaching work and Code enforcement.

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A Study of the Induction Motor

By F. T. Chapman. John Wiley & Sons, New York. 289 pages illustrated. Price, $5.50.

The theory of the induction motor is developed by a resolution of the air-gap field in sine distributed components, with the fundamental playing the prominent part in power transfer. The equations and circle diagrams are based on smooth surface stator and rotor of infinite permeability, with air-gap corrections to ratify the errors in these assumptions.

The rotating field is the basic principle developed and the author does not treat of commutator types of motors. Only algebra and geometry are used and many illustrations and examples are given to clarify the subject. Design and graphical presentation of design elements are featured, rather than the applied engineering aspects of the motors.

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Kompensierte und Synchronisierte Asynchronmotoren

By H. F. Schait. Julius Springer, Berlin. 104 pages. 60 illustrations. Price, 10.50 reichsmarks.

Rates that favor consumers of energy at a high power factor provide an economic incentive for installing compensated motors. This modification of the simple induction motor is therefore a matter of interest, at least in the larger sizes, where it finds use either by itself or for improving conditions in installations including smaller non-compensated machines. German engineers and manufacturers seem to have given proportionately much more attention to all sorts of a.c. commutator motors than has been the case in this country, and German writings in that field are numerous.

In the present book the precise circle diagram of the transformer and of the induction motor in general is first worked out; on this as a basis there follows the theory of the compensated non-synchronous and of the synchronous-induction motor.

Men of the Industry

F. H. Hill Elected President of Elmira Utility

FREDERIC H. HILL, vice-president and general manager of the Elmira Water, Light & Railroad Company since 1918, was elected president of the company at a recent meeting of the board of directors, to succeed E. G. Connette. In addition to his local duties, Mr. Hill is general manager of the southwestern

New York group of the Associated Gas & Electric System.

Mr. Hill's life work has been the building up of the Elmira utility and his biography is in reality a history of the company's development under his progressive management. He went to Elmira as a young man—33 to be exact—in the capacity of chief engineer, equipped with a technical education, some practical engineering experience and the public service point of view. It was exactly this combination which was needed for the managership of the Elmira properties in 1913, when considerable reorganization work was necessary, both in the physical property and in the field of public relations. Sensing at once the antagonism existing between the company and the public and realizing the importance of removing this misunderstanding, he devoted his attention to establishing a cordial and personal relationship with customers, by establishing a complaint department where criticism could be brought, by organizing a home economics department for the purpose of helping housewives, by making the customers partners in the business through customer-ownership campaigns and, above all, by maintaining rates which were attractive to the consumers and at the same time fair to the company. Public relations became less complicated and the physical improvement of the properties naturally followed.

Mr. Hill assumed wider responsibilities as general manager and later as vice-president and general manager, and now as president he heads a company which is playing a vital part in the prosperity of Elmira and surrounding towns. He is a leader in civic activities and organizations, as well as in several of the leading local industries. He had a large part in securing for Elmira the Morrison Machine Products Company and the Key Bolt Appliance Company and is now vice-president of these companies. He is president of the Elmira Airport Corporation, director of the Chemung Canal Trust Company, and a director and vice-president of the Latta Brook Sands & Gravel Corporation.

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MASAHARU HOSHIAI, assistant professor of electrical engineering of the faculty of engineering of Tokyo Imperial University, is now in New York, having been sent to America for a year's stay by the Denki-Gakkwai, which is the Institute of Electrical Engineers of Japan, under a grant from the Iwadare fund for the encouragement of electrical science. Professor Hoshiai is the first person selected under this endowment. Professor Hoshiai was graduated from the electrical engineering course of the Imperial University in 1922 and has since devoted his time to the study and teaching of electrical science at the University.

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CLARENCE L. LAW, general commercial manager of the New York Edison Company, and assistant to vice-president of the Yonkers Electric Light & Power Company, was elected president of the Electrical Association of New York, at its recent annual meeting. Mr. Law is a prominent figure in the electrical industry. He has been general secretary, director, treasurer and president of the Illuminating Engineering Society, and has also served the National Electric Light Association as chairman of numerous committees. He has been active in the Empire State Gas and Electric Association, American Institute of Electrical Engineers, Association of Edison Illuminating Companies and American Association for the Advancement of Science.

J. L. Buchanan Heads G. E. Supply Corporation

J. L. BUCHANAN, who has been executive vice-president of the General Electric Supply Corporation since its organization, has been named president, according to an announcement made by Gerard Swope. Mr. Buchanan first became identified with the General Electric interests in 1904, when he entered

the testing department at Schenectady. Completing his course, he spent two years in the transformer engineering department and one year in the transformer sales department at Schenectady. In July, 1909, he was transferred to the Chicago office of the company as transformer specialist and assistant supply manager. Returning to Chicago in 1919, following military service, he reentered the Chicago office, became president in January, 1920, of the Wesco Supply Company of St. Louis, then president, on March 1, 1927, of the Midwest General Electric Supply Corporation, Kansas City, and finally, on June 1, 1928, chairman Central States General Electric Supply Corporation, Chicago.

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LOUIS MACKLER has been appointed consulting engineer to the P. F. O'Keefe Advertising Agency, Inc., which has offices in both Boston and New York. Mr. Mackler's former connection was as electrical engineer with L. T. M. Ralston, Inc., New York, and in that capacity he was in charge of the design of the plans and wrote the specifications for the electrical installation in the Chrysler Building.

New England Power Names Six Group Managers

RETAIL utilities owned, controlled or operated by the New England Power Association have been divided into six major operating groups, each headed by a manager whose appointment has just been made public by W. C. Bell, Boston, vice-president in charge of retail operations. Each manager will serve as the ranking local executive officer of all the companies in each group. The appointees are: Roy F. Whitney, southern group, headquarters at Providence, R. I.; Leon E. Seekins, central group, Worcester, Mass.; Guy K. Dustin, western group, Northampton, Mass.; Everett B. Collins, northern group, Bellows Falls, and other Vermont properties; George W. Perry, southeastern group, headquarters at Quincy, Mass.; and John West, northeastern group, headquarters at Arlington, Mass. These allocations of executive responsibility have been made necessary by the recent enlargement of managerial interest on the part of the Power Association in the properties grouped under the Massachusetts Utilities Associates set-up formerly under the supervision of C. D. Parker & Company, Inc., of Boston.

Guy K. Dustin has been identified with the gas and electrical industries for some years as general manager of the Massachusetts Lighting Companies, and with previous connections with the Columbia Railway, Light & Power Company, Columbia, S. C.; the United Gas & Electric Corporation, New York, and gas companies at Hartford, Conn.; Chicago and Binghamton, N. Y.

Leon E. Seekins has been vice-president and general manager of the Worcester Electric Light Company since the spring of 1929, coming to this property from the Lowell Electric Light Corporation's managership. He is a native of St. Albans, Me., and his earlier work in the industry included a term with the General Electric Company at Schenectady and varied electrical and power plant activities with the Lowell company, then under the management of Stone & Webster. From 1928 to 1929 he was manager of the Cape Breton Electric Company, Sydney, N. S.

Everett B. Collins has had about fifteen years' experience with the New England Power Company system, including service in the load dispatching, electrical engineering and construction departments and more recently as supervisor of retail companies and assistant vice-president. At one time he was assistant to the superintendent of power for the Adirondack Electric Power Corporation, Glens Falls, N. Y., following a connection with the General Electric Company at Schenectady. He will retain his post as assistant vice-president of the Power Association.

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George W. Perry has been for the past twenty years manager of the retail utility companies of C. D. Parker & Company, with headquarters at Boston. Before that he was manager of the Weymouth Light & Power Company, hydraulic engineer for the Pacific Gas & Electric Company, erecting engineer for the Lombard Governor Company and designer for the Lawrence Pump & Engine Company. He is one of the best known operating men in New England central-station circles.

John West entered the utility field at Montgomery, Ala., soon becoming manager of the local lighting property. In 1908 this was sold to the Doherty interests and Mr. West joined the staff of the Boston Consolidated Gas Company, later going to Joplin, Mo., in connection with the organization of the Empire District Electric Company for the Doherty group. He returned to Boston in 1910 and was appointed the first power sales engineer of Charles H. Tenney & Company. In 1920 he and Alexander Macomber established the consulting engineering firm of Macomber & West, Boston, and practiced in the South and West as well as in New England.

Roy F. Whitney has been ranking executive of the New England Power Association interests in the Rhode Island - southern Massachusetts territory for the past eighteen months. He was born at Chelsea, Mass., and his early career included construction work in the West and railroad service in the East. In 1906 he joined the organization of Charles H. Tenney & Company, Malden, Mass., later becoming assistant to the general manager. In 1909 he was appointed general manager and treasurer of the Tenney property at Oswego, N. Y., returning to New England in 1918 as general manager and later president of the Fall River Electric Light Company, which joined the association in 1929. His headquarters were soon transferred to Providence, R. I., where he assumed the direct management of the Narragansett Electric Company and was in charge of the other association properties in this region.

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THOMAS A. EDISON has left West Orange, N. J., to spend the remainder of the winter at his home in Fort Myers, Fla.

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B. M. TASSIE, manager for Manning, Bowman & Company, Meriden, Conn., in the Pacific Coast territory has been elected vice-president and general manager to succeed the late Reginald P. Tracy, who served as president and general manager. Mr. Tassie was named assistant to the president in June.

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THOMAS L. HANSON of Perth Amboy has been appointed a member of the Board of Public Utility Commissioners of New Jersey by Governor Larson. Mr. Hanson, who is Governor Larson's secretary, was admitted to the bar in 1916. He was a civil engineer before he became a lawyer.

•

RAY W. TURNBULL, formerly Pacific Coast district manager for the Edison General Electric Appliance Company and recently named vice-president of the company in charge of sales, was the guest of honor at a luncheon held in the Palace Hotel in San Francisco January 15 to bid him godspeed on the eve of his departure for Chicago to take up his new duties. Mr. Turnbull is well known in electrical circles.

Financial and Statistical News

MORE than $250,000,000 of new power and light securities offered to the public this year to date apparently are being absorbed without clogging the bond market, as prices continue relatively firm. Several other sizable issues are stated to be ready for flotation as soon as securities already offered appear to be well out of the way.

——UTILITIES WHICH HAVE ALREADY REPORTED on complete 1930 operations show better earnings statements than were generally anticipated. Commonwealth & Southern, for example, has earned its 60 cents and will not have to cut its dividend, as was rumored. Public Service Corporation of New Jersey and other large systems have exceeded their 1929 figures.

——UTILITY COMMON STOCKS ARE SLIGHTLY ABOVE last week's levels. A representative group of 37 holding and operating company stocks average 67, against 66 last week. January's average changes have been negligible, however.

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New Year's Hilarity Adds 526,000 Kw.-Hr.

NEW YORKERS GREETED the new year with considerably more joy than was shown a year previously, according to statistics of the New York Edison System. Between 9:45 o'clock on New Year's Eve and 5 o'clock the next morning 526,000 kw.-hr. was used in excess of the consumption for the same period on the previous night. Last year the figure was 461,000 kw.-hr. Also, this year's observance, according to the electrical energy used, started earlier, beginning at 9:45 p.m., while the increase a year ago did not begin before 10:30. In both years the load returned to the figure of the preceding night at 5 a.m. The figures apply to Manhattan, The Bronx, Brooklyn, Queens, Yonkers and Westchester. The peak load did not come at midnight, but at 1 a.m., when it was 130,000 kw. above the consumption on the previous night.

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Energy Output Decreases Slightly

THE PRODUCTION OF ELECTRICITY by the electric light and power industry of the United States for the week ended Saturday, January 24, was 1,719,345,000 kw.-hr., according to the statistical research department of the National Electric Light Association. For the country as a whole this is a decrease from the previous week, and it is 5.9 per cent below the corresponding period in 1930 and 0.1 per cent below the same week of 1929. The most important decrease from 1930 is in the central industrial region, 8.7 per cent.

The output in kilowatt-hours during recent weeks, with earlier comparable figures, is shown in table below.

Week Ended	1931	1930	1929	—Per Cent Change— 1931 from 1930	1931 from 1929
Jan. 10	1,707,233,000	1,806,213,000	1,720,467,000	—5.5	—0.8
Jan. 17	1,727,072,000	1,826,044,000	1,731,202,000	—5.4	—0.2
Jan. 24	1,719,345,000	1,827,147,000	1,721,383,000	—5.9	—0.1

NEW CAPITAL ISSUES

First and refunding mortgage gold bonds of the Philadelphia Electric Company were offered at 93½ and interest to yield 4.34 per cent, a piece of financing involving a total of $40,000,000. Proceeds of these 40-year bonds will be used to redeem bonds and to reimburse for property acquisitions and additions and improvements.

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Kansas City Power & Light Company has made an offering of first mortgage gold bonds, 4½ per cent series, due 1961, to the amount of $27,000,000, the price being 102¾ and accrued interest, to yield more than 4.33 per cent. Proceeds of these bonds will be used to redeem on April 6, 1931, the outstanding $25,000,000 first mortgage 30-year 5 per cent gold bonds, series A, due 1952, and to provide funds for other corporate purposes.

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First lien and refunding mortgage gold bonds, series D, amounting to $4,000,000 were issued by the Houston Lighting & Power Company during the week under review. These securities mature November 1, 1978.

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Public Utility Expansion Depends Upon Successful Equity Financing*

By HENRY R. HAYES

Vice-President Stone & Webster and Blodget, Inc.

OPPORTUNITY for expansion in the public utility business certainly seems to be as promising as in the past. This spells the need for new capital. Capital must be raised in money markets which are highly competitive. A sound financial set-up of an operating utility would require that not more than 50 or 60 per cent of the investment be in interest bearing obligations, that from 20 to 25 per cent be in preferred stocks, and that the balance, 20 to 25 per cent, be raised by the common stock or equity. It is the latter class of investment which has to take the greatest risk and consequently is entitled to the greatest profit. Unless there can be a much clearer public understanding of the power industry and what is necessary for its future growth, there will exist some difficulty in raising the equity money so much needed for the business, or else money put into the business will cost more should conditions not be favorable from the investor's point of view. When this condition exists the senior securities are generally affected adversely. Cost of money is an important element in the cost of light and power. An investor

**From an address before Security Owners' Association, New York, January 22.*

does not have to put money into the business unless he so desires. There are ample opportunities for him to invest with safety, with promise of attractive returns. . . .

Regulation by commissions

When one attempts to read the statements alleging failure in statewide regulation I have always felt that many who express such views have not a clear knowledge of precisely what regulation has accomplished in most of the states. There is no question in my mind but that one of the soundest public policies adopted generally throughout the United States is state regulation of the public utility business. By it the industry is limited to such profits as may be deemed a fair return on property used and useful in the public service. In consideration of this limitation of profit the investor is protected against competition, the establishment of confiscatory rates or confiscation of property rights. The uniformity of state commission and court decisions has built up a well-developed principle of protection of capital in the business, as well as protection to the public served. You will agree with me, I am sure, that this principle is one of the prime factors which have resulted in obtaining the capital needed to develop the business. This industry in 1902 had an investment in plant and equipment of $504,740,000. In 1927 that investment had been increased to $8,675,000,000, and is now estimated to be $11,850,000,000. The industry could not have enjoyed this expansion except under the establishment of sound principles through state-wide regulation and judicial decisions. This expansion has through progressive and able management brought wide-flung light and power service of a reliable character—a real public service. It is evident, therefore, that state regulation has not failed. On the other hand, it can be shown that state regulation has not been universally adequate. It has seemed to me that where it has not been adequate the causes lie not in the theories and principles of state regulation, but rather in failure along administrative lines. There is a lack of uniformity of laws in the various states. Legislatures, too, often fail properly to finance commissions. The commissions should be composed of men of experience and good judgment, adequately compensated, with sufficient appropriations to cover fully the expense of investigations to be made. The findings should be published and periodic releases of essential financial and operating data placed before the public.

The industry has grown so fast that mergers and consolidations have taken place in great volume. Most of these consolidations have been according to economic requirements, for the purpose of saving capital investment, lowering generating and transmission costs and improving and broadening the character of service. Where these conditions have not been accomplished the confidence in the business has been adversely affected. Therefore, let nothing be done to interfere with the sound principles which have been established through commission and court decisions. The maintenance of the present method of granting, under state commission for the purpose of regulation, a monopoly of service, has the further distinct advantage of reserving to the states rights that should not be usurped by the federal government, especially when such a small percentage of output of the power industry crosses state lines. President Hoover has already recommended ways and means by which interstate power should be regulated by the Federal Power Commission in the limited number of cases needed. This is a sound policy.

Accounting systems discussed

Where adequate state regulation does not exist it is most vital for the managements and the investors to see to it that laws are enacted and funds appropriated which will result in perfecting this aspect in the regulation of the industry. In limited cases we see unfair results prompted by too much or too little regulation. It has been claimed that the accounting systems adopted have not been adequate. I do not believe this to be a fact. The accounting practice of the industry conforms to a uniform classification of accounts promulgated by the National Association of Railway and Utilities Commissioners. Among those who claim that state regulation has failed there are many who are advocates of public ownership and operation of the electric light and power business. Such advocates like to cite many instances of successful operation under government or municipal ownership. The real basic fault in such claims is that in most instances of public ownership and management there is an obvious lack of sound accounting principles in so many of the cases cited. This condition, unfortunately, under public management of business enterprises is not confined to the electric light and power industry. It is high time, in the interests of taxpayers, that we insist that the various branches of government shall at least adopt accepted principles of accounting.

Court cases

In explanation of some proposed legislation we have heard much of the need of having cases go first into the

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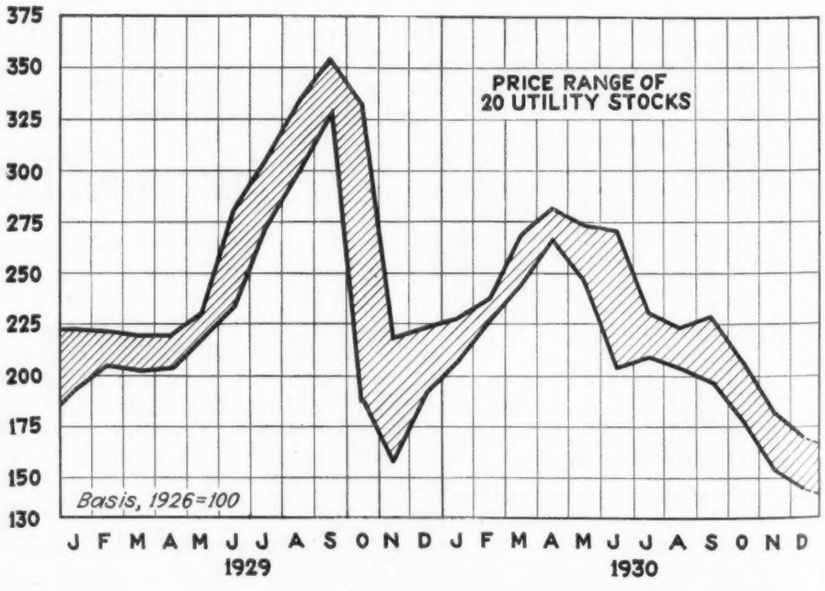
Is the Next Movement Upward?



FLUCTUATIONS IN THE PRICE range of twenty representative utility stocks as compiled by Standard Statistics, Inc., are shown in the accompanying chart. Levels at the beginning of 1931 as shown are below those at any time during the past two years. The graph serves to illustrate the background of activity of these issues through the bull market, the market crash of November 1929 and the subsequent sharp rise and steady decline extending with minor interruptions up to the present. January averages changed little.

state courts, rather than to the federal courts, and that there has been too free access to the federal courts by the public utility industry. A careful study of this situation disclosed that not one-tenth of 1 per cent of the cases handled in the last fifteen years by the state commissions have been taken into the federal courts. There has been a total of 1,497 appeals, and of this total number of cases, 318 involved rates and 177 involved valuation.

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Associated System Has Retired $121,000,000 Underlying Issues

By STACY O. SEARS

Vice-President Associated Gas & Electric Securities Company, Inc.

SO RAPID has been the development of the utility industry that few realize the enormous amounts required to finance new construction and the purchase of additional properties. Where a manufacturing concern may make such expenditures out of earnings or surplus, the utilities, in return for a franchise to operate in certain territories, are restricted to earnings which will pay a fair return on the capital invested.

In this article it is proposed to show what the larger utility groups, and particularly the Associated Gas & Electric Company, are doing to simplify the complexity of their financial structures resulting from acquisition of subsidiary companies.

Following out its group financing plan, the Associated system made a pronounced reduction in the amount and number of underlying issues during the period from 1925 to 1928. As shown by the accompanying table there were outstanding 93 underlying issues at the end of 1925, which had been reduced to 37 by 1928, with an increase of only four parent company issues. It is interesting to note that of these remaining issues, there were only four subsidiary preferred stocks totaling approximately $145,000 and two underlying common stocks totaling $3,400.

While it was necessary to issue additional parent company and underlying securities during the four-year period ended 1929, 103 underlying issues had been retired, while the parent company showed a net increase of only eight issues. In addition to this retirement of underlying issues, there was also a considerable reduction in the size of other outstanding underlying issues which is not reflected in these figures.

There are two methods by which the number of underlying issues can be reduced:

1. Purchase for cash.
2. Exchange for parent company securities.

The latter has been the method followed by the Associated Gas & Electric Company. In view of the fundamental policy upon which Associated financing is based, namely, the reduction of underlying debt through financing by securities of the parent company, it is natural that the number and amount of parent company issues should show an increase. This increase, which illustrates the extent to which simplification has taken place, is as follows:

	1925	1929
Amount of parent company securities	$83,000,000	$593,000,000
Amount of underlying securities	93,000,000	215,000,000

The accomplishment in simplification of finances achieved by the Associated Gas & Electric Company during this period can better be appreciated when it is realized that, while the number of customers served tripled, the amount of underlying securities increased only 130 per cent. The increase in amount of parent company issues was only moderate when compared with the total amount of capital involved.

New Issues and Retirements Since 1925

	Issues at Dec. 31, 1925	Additions to Dec. 31, 1928	Retirements to Dec. 31, 1928	Issues at Dec. 31, 1928	Additions in 1929	Retirements in 1929	Issues at Dec. 31, 1929	Total Issues Retired, '25 '29
Parent company—funded debt	2	8	4	6	3	..	9	4
Parent company—conv. issues	11	9	10	10	4	3	11	13
Parent company—preferred stocks	4	1	..	5	..	..	5	..
Parent company—A, B & common	3	..	..	3	..	..	3	..
	20	18	14	24	7	3	28	17
Underlying—funded debt	67	33	69	31	43	2	72	71
Underlying—preferred stocks	12	9	17	4	21	..	25	17
Underlying—common stocks	14	2	14	2	10	1	11	15
	93	44	100	37	74	3	108	103

NEWS BRIEFS

Records of the Railroad Commission of California show that during the year 1930 it authorized the issue of stock, bonds and notes by public utility corporations in the amount of $302,150,259, as compared with authorizations of $103,288,474 granted during the calendar year 1929. This is the largest amount authorized in any year in the history of the commission.

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Knoxville Power & Light Company, Inc., New York City, has filed a certificate in the office of the Secretary of State changing its corporate name to Tennessee Public Service Company, Inc. Fort Worth Power & Light Company, Inc., New York City, has filed a certificate in the office of the Secretary of State changing its corporate name to Texas Electric Service Company, Inc. Papers in both instances were filed by Electric Bond & Share Company, New York City.

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Public Service Corporation of New Jersey will mail, February 28, to its preferred and common stock holders rights to buy their proportionate share of an issue of 344,013 shares of $5 cumulative preferred stock without nominal or par value. The additional issue was authorized by the corporation's board of directors at a meeting held January 20. Stockholders of record as of January 31, 1930, may subscribe at $97.50 per share, at the rate of one share of the new issue for each twenty shares of common or preferred stock owned. Stock may be paid for in full on March 31, when rights expire, or at the rate of $10 per share on March 31 and $10 a share each month thereafter until paid for.

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An offer has been made to holders of Rochester Central Power 6 per cent cumulative preferred stock and 5 per cent gold debentures, series A, due in 1953, to exchange their holdings, respectively, for $6 dividend series preferred stock of the Associated Gas & Electric Company and 5 per cent convertible debentures of Associated. The preferred stock will be exchanged on a share-for-share basis and the exchange of debentures will be effective on a par-for-par basis. This offer is subject to the condition that Associated Gas & Electric will not be obligated to make any exchange unless at least $10,000,000 principal amount of Rochester Central Power debentures are deposited for exchange and 48,000 shares of preferred stock.

Business News and Markets

R. & I. Engineering Buys Canadian Unit

PURCHASE OF THE Eastern Power Devices, Ltd., of Toronto, at present manufacturer of indoor and outdoor switching equipment in Canada, has been announced by the Railway & Industrial Engineering Company of Greensburg, Pa. After February 1, 1931, Eastern Power Devices, Ltd., will manufacture a complete line of "Hi-Pressure" contact equipment now covered by Railway & Industrial Engineering Company patents. The head office and distributing center for the whole of Canada will be located at 1244 Duffern Street, Toronto. W. J. Gilson, electrical engineer of Eastern Power Devices, has been retained as general manager.

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Standard Color Card for Flexible Cord

THE FLEXIBLE CORD GROUP of the National Electrical Manufacturers' Association has just issued the first N.E.M.A. standard color card for flexible cord. This card contains samples of colored cotton and rayon braids, fourteen colors of each, together with corresponding color names and numbers.

This new plan of issuing a single color card under the N.E.M.A. insignia is of benefit to both purchasers and suppliers of cord. Each purchaser now need keep only one kind of card. The makers of the cord will be saved the expense of duplication as each maker need not separately print and distribute his own card. The cards are 3⅛ and 6⅛ in. in size and are durably made.

The following companies are members of the flexible cord group, which is part of the association's wire and cable section:

American Insulated Wire Corporation, Anaconda Wire & Cable Company, Belden Manufacturing Company, Collyer Insulated Wire Company, Crescent Insulated Wire & Cable, Inc., Davis-Jones Insulated Wire Company, Diamond Braiding Mills, Driver Harris Company, General Cable Corporation and divisions and the General Electric Company.

Also, Goodyear Rubber Ins. Company, Habirshaw Cable & Wire Corporation, Hatfield Rubber Works, Inc., Indiana Rubber & Insulated Wire Company, National Electric Products Corporation, Northern Electric Company, Ltd., Okonite Company, Rockbestos Products Corporation, U. S. Rubber Company (wire division), Wheeler Insulated Wire Company and J. M. White.

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Electrical Manufacturing Index Rises

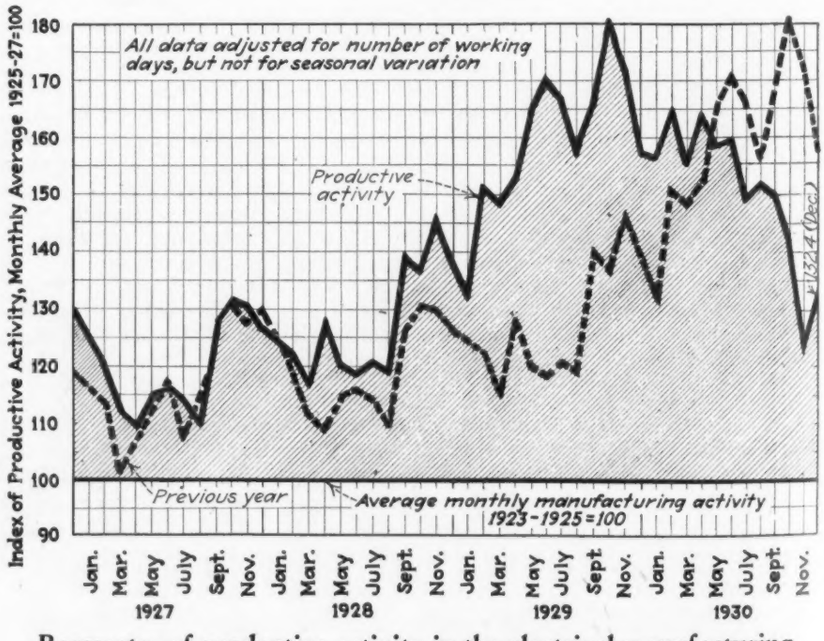
PARTIAL recovery from the low level reached in November is indicated in December reports of energy consumption in electrical manufacturing establishments, reflecting an increase in activity in that branch of the manufacturing industry. Adjusted for the difference in the number of working days, the December index is 6.3 per cent above that for November, but remains 15.7 per cent lower than it was a year ago. The November index was 26.7 per cent below last year's.

Figures rounding out the year invite attention to annual averages: 1930 stands only 5.8 per cent below 1929; it exceeded 1928 by 18 per cent and earlier years by successively wider margins as we go farther back. Comparison with the composite index for all industries reveals the favorable position of the electrical branch; the former was down 14.6 per cent compared with 1929 and, unlike the electrical, was lower in 1930 than in 1928.

The improvement over November was not uniform. In general it would appear that plants producing heavy apparatus increased their energy consumption; in appliances and to a certain extent in radio there are indications of an upward movement. In many plants, however, the downward movement, which had been delayed long after it affected other industries, but which set in during the latter part of 1930, has continued with December activity lower than in November.

Comparative Index Numbers

December, 1930	132.4
November, 1930	124.2
October, 1930	140.6
September, 1930	150.0
December, 1929	157.0
November, 1929	169.5
Twelve months of 1930	150.5
Twelve months of 1929	159.8



Barometer of productive activity in the electrical manufacturing plants of the United States

Copper Market Dull

LITTLE OR NO IMPROVEMENT in metal consumption is yet evident except where seasonal conditions prevail, as in the automotive and paint industries. Both domestic and foreign demand for copper have been very slight recently, rumors that concessions might be made in the 10-cent price evidently scaring off the buyers of the few thousand tons that have been entering the market weekly since the first of the year. The foreign sales, which promise to be about 35,000 long tons for January, are not far from the average of the last six months, though foreign buying has been quieter the last few days.

	Jan. 21, 1931 Cents per Pound	Jan. 28, 1931 Cents per Pound
Copper, electrolytic	10	10
Lead, Am. S.& R. price	4.75	4.75
Antimony	7⅛	7⅛
Nickel, ingot	35	35
Zinc, spots	4.35	4.40
Tin, straits	26⅛	25.80
Aluminum, 99 per cent.	23.30	23.30

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Farm Equipment Handbook Issued

DESCRIPTIONS OF ALL TYPES of electrical equipment for farm use have been combined in one publication, circular 1878, Electrical Farm Equipment, published by the Westinghouse Electric & Manufacturing Company. It includes descriptive information and complete ratings covering all Westinghouse electrical apparatus having applications in rural electrification and presents considerable engineering data, making it a useful sales and engineering handbook for those engaged in rural electrification. Some of the products described in this publication are radios, refrigerators, water systems, water heaters, ranges, motors, vacuum cleaners, heating and cooking appliances, battery chargers, fans, service plants, etc.

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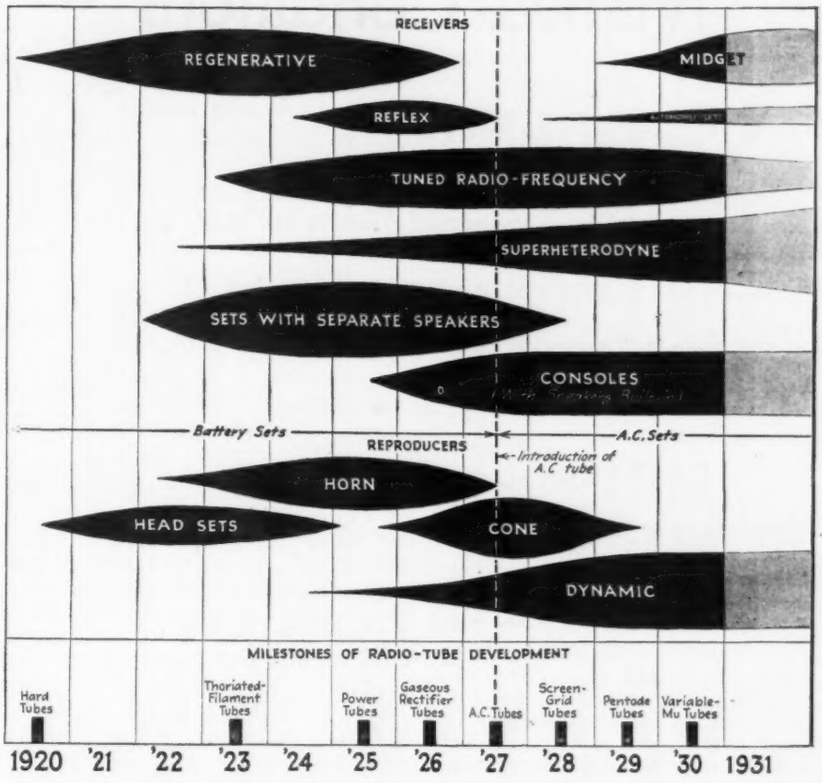
Pacific Gas Buys Four Transformers

AN ORDER TOTALING more than a quarter of a million dollars has been placed with the Westinghouse Electric & Manufacturing Company by the Pacific Gas & Electric Company. This covers four 25,000-kva., self-cooled air-blast transformers to be installed at the Herndon substation, near Fresno, about 100 miles southeast of San Francisco.

Herndon will be a primary step-down substation at the San Joaquin end of the new line linking Pacific Gas & Electric Company and San Joaquin Light & Power Company.

THE RISE AND FALL OF THE RADIO GIANTS



Striking evidence of the everchanging and kaleidoscopic nature of the radio business is presented by the above diagram, showing the growth and wane of various types of radio sets, speakers and tubes. With vertical columns representing the years of the decade since 1920, the chart traces the inception, expansion and development of radio products through the years. A glance at this moving picture of radio change and radio progress will show how vigilant must be the manufacturer, distributor or dealers to keep up with the procession.

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TRADE BRIEFS

C. H. Wheeler Manufacturing Company announces that F. A. Faville has joined the company as manager of its Chicago office.

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Northern Blower Company, Cleveland, Ohio, has appointed C. H. Keeney as sales manager.

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The Sterling Engine Company has opened a New York office to dispense information and for convenience of New York clients who have been using Sterling commercial engines. William Edgar John is manager.

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J. M. Frank, president of the Ilg Electric Ventilating Company of Chicago, has been elected president of the National Association of Fan Manufacturers.

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Trumbull Electric Manufacturing Company Pacific sales division has been organized, with headquarters at 432 Fourth Street, San Francisco, Cal., under the management of H. F. Yost, who will be responsible for the distribution of the products of the Seattle, San Francisco, Los Angeles, Ludlow, Ky., and Plainville, Conn., factories of the Trumbull Electric Manufacturing Company in the Pacific Coast territory.

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General Electric Stockholders

STOCKHOLDERS OF THE General Electric Company increased in number between December, 1929, and December, 1930, by 56,376. The total number of stockholders at the present time is 116,750, the largest in the company's history.

Most of these are holders of the company's common stock, of which there were 107,150 on record December 19, 1930. Of this number a certain proportion also owned the company's special stock, and in addition 9,600 individuals own special stock only. This increase in number of stockholders has been accompanied by an increase in the geographical distribution of the stock.

Market Conditions

VERY definite evidences of expanding equipment business are noted on the Pacific Coast this week. New construction shows signs of being especially heavy in the near future. A wide range of orders is reported, covering every branch of industry. Little change is noted in volume of new orders in the Middle West and Southwest areas.

——WHILE HAND-TO-MOUTH BUYING CONTINUES in the Eastern district, inquiries are increasing steadily and manufacturers are more optimistic with regard to immediate business. This is true also of the Southeast.

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EASTERN

—PENDING ORDERS CONTINUE *to persist in the electrical equipment market in the Eastern district, and with an advancing quota of inquiries for quotations, manufacturers are anxiously awaiting actual commitments. Immediate buying is from hand-to-mouth character and has developed a sluggish situation.*

—CENTRAL-STATION BUSINESS *carries rather definite promise within the next 30 to 60 days, while industrial account shows tendencies of advancing to more satisfactory levels for motors, electric drives, control apparatus and kindred equipment.*

General Electric Company has tendered a bid for electrical equipment for towing locomotives for government service at the Panama Canal, totaling $34,608, and is expected to secure the award. General Cable Company has been awarded a contract for 75,000 ft. of low-tension electrical cable for the naval aircraft factory at Philadelphia, at a unit price of $8.85 per thousand feet. McClintic-Marshall Company, Pittsburgh, will furnish steel towers for a transmission line for the Union Electric Light & Power Company, St. Louis, in connection with its hydro-electric power development now under way on the Osage River. Lapp Insulator Company has secured the award for high-tension strain insulators for the line; cable commitments have gone to the Graybar Electric Company and John A. Roebling's Sons Company. Fairbanks, Morse & Company have tendered a bid of $109,000 for a Diesel engine-generator plant for electric lighting service at Price, Utah.

Appalachian Electric Power Company will install General Electric and Westinghouse generators at its hydro-electric power plant on the James River, near Lynchburg, Va.; the first noted company will build three 2,500-kw. units and the Westinghouse company has an award for two similar machines. All of the waterwheels will be furnished by James Leffel & Company. This project will cost over $1,000,000 and early commitments for other equipment and supplies are expected. The Westinghouse Electric & Manufacturing Company has sold a new type of synchronous motor with magnetic control, rated at 1,250 hp., to the Marquette Cement Company for tube mill service at its plant at Cape Girardeau, Mo.

CONSTRUCTION PROJECTS

Signal Supply Officer, Army Base, Brooklyn, N. Y., will receive bids until February 10 for 500 insulators, 1,800 capacitors, switches, plugs, etc. (Circular 77). United States Rubber Company, New York, plans expansion program at plants at Detroit, Mich.; Eau Claire, Wis., and Los Angeles, Calif., to cost over $250,000. General Electric Company, Schenectady, N. Y., is taking bids for addition to plant at Cleveland, Ohio, to cost about $500,000, with equipment. Victor Mayper, 110 West Fortieth Street, New York, architect, has plans for a fifteen-story factory on Chambers Street to cost $300,000. International Pipe & Mining Company, affiliated with Herbert Kennedy Company, New York, plans plant at New Castle, Del., to cost about $100,000. Ajax Metal Company, Philadelphia, Pa., has plans for an addition to cost $115,000. Ursinus College, Collegeville, Pa., has plans for institutional buildings to cost $500,000. McKeesport, Pa., plans trade and industrial school to cost $800,000. Duquesne Light Company, Pittsburgh, Pa., plans installation of electric precipitation equipment for dust elimination at different power plants. Consolidated Gas, Electric Light & Power Company, Baltimore, Md., contemplates transmission line to connect with plant of Safe Harbor Power Company, now in course of construction, to cost about $400,000, including steel towers. Division of Supplies, Department of Commerce, Washington, D. C., will receive bids until February 10 for airways course lights (Proposal 22890). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until February 11 for transmission line towers (Schedule 2625), and until February 12 for wire, cable and electrical supplies (Schedule 2627).

SOUTHWEST

—REPRESENTATIVES OF THE *electrical industry interviewed report that last week's business ran along very much as that of the past few weeks. Small orders were received in continued small but steady volume.*

Some manufacturers and jobbers have given estimates on several large jobs, orders for which will be placed soon. This, of course, keeps up the optimistic tone in looking toward future business. One order was given for relays and miscellaneous oil circuit breaker and transformer equipment amounting to $10,000, and another order amounting to $22,000 was placed for switching equipment which is to be used in a municipal power plant in the Southwest.

CONSTRUCTION PROJECTS

Kansas City Power & Light Company, Kansas City, Mo., plans outdoor power substation to cost over $75,000. Board of Public Utilities, Kansas City, Kan., will receive bids until February 4 for power plant to cost over $100,000. Public Service Company of Oklahoma, Tulsa, Okla., plans ornamental lighting system at Vinita, Okla. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans extensions and improvements in power plant at Shawnee, Okla. Arkansas-Missouri Power Company, Blytheville, Ark., plans hydro-electric power plant on Spring River to cost over $300,000. Texas Rail Joint Company, Fort Worth, Tex., affiliated with Illinois Rail Joint Company, Joliet, Ill., plans plant at Fort Worth to cost close to $100,000. Hope Haven Mechanical & Industrial School, Marrero, La., plans addition to cost over $150,000.

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NEW ENGLAND

—INQUIRIES FOR HEAVY *electrical machinery are more active and interest is reported in a wide range of electrical equipment, including turbo-generators, institutional needs including d.c. machinery and marine electrical equipment.*

Recently an order for a 2,500-kw. turbo-generator was received by a prominent manufacturer. An additional 35,000-kw. unit order will be placed soon. Inquiries are being received in good volume for small power equipment from many state institutions. Small motor sales are uneven in trend. According to one manufacturer a slight gain during the first two weeks of this month is noted as compared with the previous month. Central-station supplies are quiet; last week an order for a bank of 50 150-kva. and 200-kva. transformers was recorded for rush delivery. Inquiries for insulators have gained, according to one representative.

Announcement of the plan to construct a new substation in western Massachusetts requiring two 15,000-kva. transformers is encouraging. Scheduled materials are steady. Some specialties are in fair demand, notably electric recording meters, electric clocks and interior illumination units.

CONSTRUCTION PROJECTS

Board of Education, New Canaan, Conn., plans installation of manual training and other science departments in junior high school to cost $300,000, for which bids will be received until February 19. Norwich State Hospital, Norwich, Conn., plans installation of generator, engine and auxiliary power equipment. New Haven, Conn., has plans for airport hangars and buildings at Morris Cove, including floodlights, etc., to cost over $80,000.

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MIDDLE WEST

—NOT MUCH CHANGE *in general business is noticeable this week in the Middle West section. The volume of business is holding up fairly well and the consensus seems to be that the worst period for business is over.*

—ENCOURAGING REPORTS *are being received from all sections of the Middle West indicating a resumption of activity on a larger scale, with increased employment and production. Apparently the hysteria so prevalent the last half of the year has about worked itself out and industry is sanely making an effort toward recovery.*

Major activities are in an improved position and it is thought that the automobile show in Chicago will add the final touch to improve conditions in the automotive industry. A considerable amount of monev is scheduled by the railroads for new equipment and improvements, some of which is being spent at this time. The various utility companies are proceeding conservatively, preparing for a normal year. As much construction work as possible is being started and schedules for circuit revision work the first quarter of the year are quite heavy.

CONSTRUCTION PROJECTS

American Plywood Company, New London, Wis., plans addition to cost close to $100,000. Henry B. Kenny Company, Minneapolis, Minn., engineer, is drawing plans for a dairy products plant at Wilson, Wis., to cost $300,000. University of Chicago, Chicago, Ill., has filed plans for new institutional building to cost $1,200,000. Inland Steel Company, Chicago, Ill., plans strip and plate mill at plant at Indiana Harbor, Ind., to cost close to $7,500,000. Benjamin Rose Estate, Cleveland, Ohio, will build a printing plant to cost $150,000. Great Northern Railway Company, Minneapolis, Minn., has completed plans for power plants at Williston, N. D., and Whitefish, Mont., to cost about $90,000 each. Duluth, Minn., plans vocational school to cost about $80,000. Omaha, Neb., plans installation of electric traffic lighting system. Central Power Company, Grand Island, Neb., plans extensions and improvements in power substations and transmission lines at Kearney, Neb., and vicinity, to cost about $100,000.

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PACIFIC COAST

—RENEWED BUYING *of heavy equipment is definitely in evidence on the Pacific Coast. New construction work will be more extensive than was earlier anticipated.*

—BUSINESS IN NEARLY *every electrical branch seems visibly improving and the impetus of the $20,000,000 Pacific Gas & Electric campaign in northern and central California is especially marked.*

Transformer orders are especially heavy, the past week having included an order for three of 5,000 kva. capacity valued at $50,000 for the Courtland district, two of 5,000 kva. for the Chowchilla district valued at $30,000, eight 1,500 kva. General Electric units valued at $60,000 for San Luis Obispo, and $15,000 worth of Westinghouse transformers for Boise, Idaho. Other interesting orders cover $7,000 worth of General Electric crane motors and controls for Mare Island, a $20,000 switchboard and other equipment for the Hilo Electric Light Company in the Hawaiian Islands, a carload of Westinghouse ranges to a Seattle jobber, and thermostatic equipment valued at $20,000 for Portland. The week certainly features a variety of orders such as 1,100 16-in. roughed inside diffusing globes for Beverly Hills, transformers and motor-generator sets for the United States government at Fort Mason, San Francisco, turbine spares and 20 arc-welding sets for various navy yards.

Prospects include new buildings to the value of $1,500,000 for a San Francisco university, large street-lighting projects for San Mateo and Alameda, where it is estimated that 48 duplex lights will cost close to $20,000, and the underground system nearly $100,000 additional; $1,000,000 government navy appropriations for various barracks and electrical improvements along the coast, and 50 homes for the Chico district in connection with a lumber plant.

Rejecting one regular and one irregular bid received for furnishing 736 miles of transmission line conductor and accessories for projected Seattle-Diablo line, estimated to cost in excess of $800,000, Seattle Board of Public Works issued a new call for bids designating February 5 as date for opening figures. Specifications written by Seattle municipal lighting department for 36 150-kva. and 24 100-kva. submersible transformers and 252 cable external reactors and incidental equipment will be taken shortly.

Board of Contracts and Awards, Tacoma, is taking bids until February 2 for scale frame, spouts and hoppers, platform stairs and gratings and miscellaneous steel in connection with completion of municipal steam plant auxiliary No. 2.

CONSTRUCTION PROJECTS

Los Angeles Railway Company, Los Angeles, Calif., has plans for a power substation to cost about $45,000. Harbor Commissioners, San Francisco, Calif., plan pier building to cost $125,000. Beverly Hills, Calif., will receive bids until February 10 for 33,000 ft. of lead-covered cable, and at the same time for quantity of ball globes for street lights. Santa Rosa, Los Angeles and Eureka, Calif., plan ornamental lighting systems. Puget Sound Power & Light Company, Seattle, Wash., plans transmission lines in Snohomish County to cost $300,000. White River Lumber Company, Seattle, Wash., plans purchase of motors and other power equipment. Hope Mining Company, Cœur d'Alene, Idaho, plans reduction mill and electrification of mines, to cost over $125,000. Southern Colorado Power Company, Pueblo, Colo., plans transmission line extensions to cost about $200,000.

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SOUTHEAST

—INQUIRIES ARE ON THE INCREASE *in the Southeast and the general volume of business is reasonably satisfactory. While purchases this week are mostly of a routine nature, some interesting orders are expected to be placed within the next 30 days.*

A power company in Louisiana ordered regulators and oil circuit breakers amounting to $12,000, while a Georgia company ordered approximately $17,000 worth of rails for its street railway. Orders for two carloads of pole line hardware were also placed in Georgia. One company's transformer orders in the past ten days aggregated $7,550 and its meter orders last week totaled $6,650. Some other central-station orders were for $4,200 worth of wire, $3,100 worth of circuit breakers and $2,650 worth of creosoted pine poles. An ice plant in South Carolina purchased electrical equipment amounting to $2,000.

CONSTRUCTION PROJECTS

The Seaboard Public Service Company, Chicago, Ill., plans the electrification of the Delgado Mills, Wilmington, N. C., textile plant, recently acquired, reported to cost over $100,000. Georgia Power Company, Atlanta, Ga., contemplates extensions and improvements in power plants to cost over $250,000, and will build 110,000-volt transmission line from power plant at Tallulah Falls to August, Ga.

New Equipment Available

Compact Hoist Has Sectionalized Construction

A COMPACT HOIST of sectionalized construction to permit large-scale production in manufacturing of interchangeable parts has been announced by the Shepard Niles Crane & Hoist Corporation. By the use of the same body

pieces and by attaching different motor gear end sections varying requirements of speed or capacity can be met. The motors are especially designed to meet the requirements of hoisting service and are of 30-minute, 50-deg. C. rating. Cooling fins are cast integral with the gear end section inclosure.

All moving parts in the gear end operate in an oil bath, providing automatic and positive lubrication. The gears are made of steel and heat treated. An improved electric brake and limit switch, ball bearing trolley wheels for the push type trolley for ease in operating along the runway beam and balanced drive through the use of planetary gearing maintain positive alignment and greatly reduce bearing pressures, it is claimed.

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Switch for Reverse-Torque or Plug-Reverse Braking

A SWITCH FOR REVERSE-TORQUE or plug-reverse braking of a.c. motors is announced by the Monitor Controller Company, Baltimore, Md. In operation, this switch automatically disconnects the motor from the line just before it comes to rest, making the switch particularly suited to applications where the slightest motor reversal is neither desirable nor permissible.

The switch consists of a contact switch in the coil circuit of the brake-line contactor. This contact switch is held closed by pressure from an arm mounted on a friction ring and carried by a rotating shaft driven by the motor to be controlled. Normally the friction ring slips and the arm exerts no pressure on the contact arm, but when the speed of rotation increases to definite low value a quick-action and accurate centrifugal regulator throws a clutch that applies friction to the ring and thus exerts the pressure necessary to close the brake contactor circuit. This contact remains closed until the brake circuit comes into action and the motor slows down to the critical trip-speed, when the centrifugal regulator snaps back to normal position and the brake circuit is opened, disconnecting the motor from the line.

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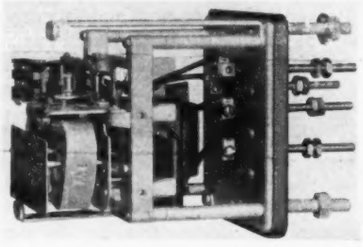
Induction Relay for Undervoltage Protection

AN INDUCTION RELAY, designated type IVA, for undervoltage protection of alternating-current circuits has been announced by the General Electric Company. It is a single-pole, single-circuit device and has circuit-closing contacts. It is applicable to circuits of 600 volts or less and to circuits of higher voltages with the 110-volt secondaries of potential transformers. It is available for 25- and 60-cycle service.

The relay has a universal design of rectangular case which harmonizes with switchboard instruments and meters which are now standardized



with similar cases. It is only 5½ in. wide. Four such relays may be mounted side by side on a panel 24 in. wide. A glass front and light finish of certain parts permit ready inspection. The contacts are self-aligning, the stationary member being individually adjustable and the movable member a silver disk which provides different points of contact. When the relay has operated, a target indicator is visible from any front angle.

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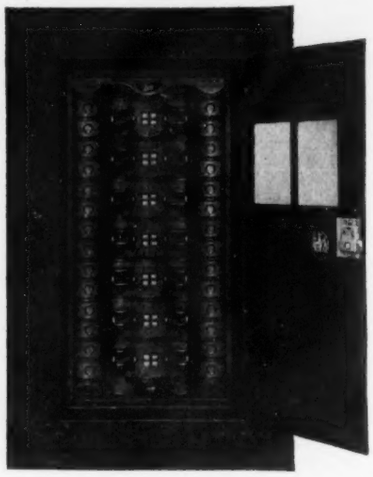
Lighting Panels Permit Quick Connection Change

THE "SUPERBA" LINE of lighting panels, composed of bakelite units of curved design, in contrast to the conventional straight lines heretofore fol-



lowed in panelboard design, is announced by the Bull Dog Electric Products Company, Detroit, Mich. It incorporates flexible features of design and construction to permit ready change of circuit connections for both voltage and phase without removing the door and trim or disturbing the wiring connections.

Either plug or cartridge fuse connections and single- or double-pole switches may be interchanged in these panels without removing the door and trim. Cartridge fuse type panels incorporate a fuse ejector feature for quick and easy removal of cartridge fuses. The panel itself is complete dead-front type, as individual doors over fuse compartments are an integral part of the faceplates or unit covers.

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A PENDENT TYPE PUSH BUTTON for controlling small floor-operated cranes has been announced by the General Electric Company. It is designed to supersede the present rope and chain types of control, with the advantages of greater safety to the operator, a saving in time and less aisle space required on the factory floor. The push-button station is 20¼ in. long, 2⅜ in. wide and 2 5/16 in. deep, less the projection of the buttons. It is of the proper size to be readily grasped and operated by one hand.